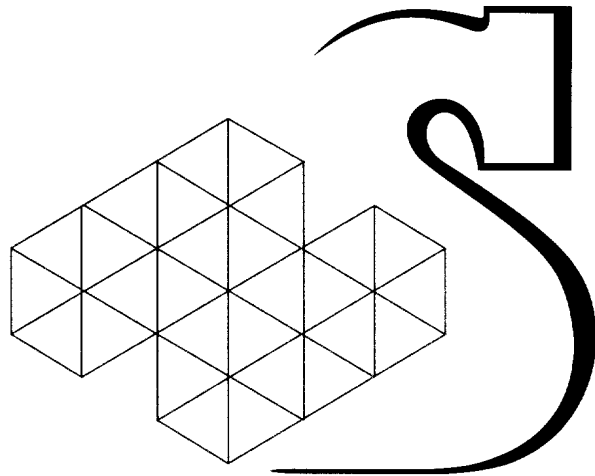


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H U M A N S Y S T E M S
Incorporated

Humansystems

111 Farquhar Street

Guelph, Ontario

N1H 3N4

Tel: (519) 836-5911

Fax: (519) 836-1722

**Human Factors Study of the
Clothe the Soldier
Temperate Combat Glove**

**PWGSC Contract No. W7711-7-7429/01-SRV
Order No. 7429-19**

March 2000

<http://www.humansys.com>

Human Factors Study of the Cloth the Soldier Temperate Combat Glove

by

Jason K. Kumagai, Harold A. Angel, David W. Tack

Humansystems Incorporated
111 Farquhar Street, Second Floor
Guelph, Ontario
N1H 3N4

Project Manager:
Jason K. Kumagai
(519)-836-5911

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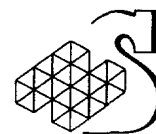
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Defence and Civil Institute of Environmental Medicine
1133 Sheppard Avenue West
North York, Ontario.

DCIEM Scientific Authority:
Walter Dyck
(416)-635-2192

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Executive Summary

As part of the Clothe the Soldier project, the Defence and Civil Institute of Environmental Medicine (DCIEM) was tasked to support the acquisition of temperate combat gloves (TCG). The TCG is a one-piece glove (i.e. no insert) intended to provide the essential dexterity and abrasion protection in temperatures of 10°C to 35°C. This report describes the results of a Human Factors evaluation trial conducted to resolve differences in fit and design (i.e. cut) and determine if two new prototype glove designs were compliant with Human Factors performance specifications.

Thirty-six regular force soldiers were selected for specific hand sizes from Whiskey Battery at CFB Gagetown and were given temperate combat gloves. All participants took part in an uncontrolled portion of the trial. Participants issued only one pair of gloves had an opportunity to expose one glove to 95 days of operational use, and half that time for those issued two pair. Data was collected primarily to assess performance criteria requiring extended operational use (fit (change in fit), protection, durability, and maintainability).

Twenty-one participants took part in the controlled portion of the trial. A two-day field trial was undertaken at CFB Gagetown over the period of November 4-5, 1999. Participants issued two pairs of gloves were required to undertake a battery of Human Factors tests while wearing the different temperate glove conditions in a repeated measures design. Human Factors tests included assessments of fit, accessibility, adjustability, compatibility, performance of clinical, military and battle tasks, thermal and physical comfort, durability, and user acceptance. Data collection included questionnaires, focus groups, performance measures and HF observer assessments.

The results indicated that both gloves were compliant with most of the HF performance requirements tested in this trial with the exception of Fit Acceptance, Gross Motor Dexterity Performance and Grip Strength Performance. Rewording of the Gross Motor Dexterity and Grip Strength Performance requirements are suggested. In terms of Fit, more than 80% of the participants included in this trial were able to achieve an acceptable overall fit. However, many individual components of the glove were rated as "too big" or "too small". In addition, the sample population used in the trial lacked representation of large hands, small hands, and hands with long fingers.

In terms of design only, participants preferred the Inseam Sewn Cut to the Reverse Gunn Cut. All participants indicated that the ideal glove would be Inseam Sewn Cut and retain the benefits of glove A. Results indicated that following 90 days of operational use, most soldiers (80% or greater) rated the durability, protection, and maintainability of the temperate combat gloves as acceptable.

The next phase of the Temperate Combat Glove project should produce and evaluate new TCG prototypes in a User Acceptability Trial. Issues related to developing a working sizing system for a more representative sample of the CF Land Force population also require further research. The Human Factors performance criteria and test methods, as validated (and modified) in the current study, should be used to support future acquisition decisions in the effort to select the best possible glove for the Canadian Land Forces.

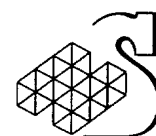
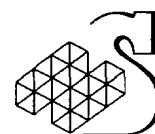
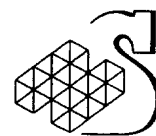


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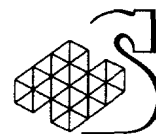
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- B. *Statement of Work: Human Factors Study of the CTS Glove System for the Land Forces*, DCIEM. August, 1999.

1. Background

As part of the Cloth the Soldier project, the Defence and Civil Institute of Environmental Medicine (DCIEM) was tasked to support the acquisition of temperate gloves. This tasking required that DCIEM determine Human Factors (HF) requirements for a temperate glove, and develop performance-based specifications, bid evaluation criteria, and test methods for use in future evaluations of bid contenders. Humansystems Incorporated was subsequently tasked by DCIEM to conduct the necessary field trials to develop performance specifications from four candidate temperate gloves with a variety of features. The priority of glove design features was determined, and draft performance specifications were developed (Ref A). Based on results of the trials, recommendations to improve the glove designs were integrated. This report describes the results of a subsequent Human Factors evaluation trial conducted to resolve differences in fit and design (i.e. cut) and determine if the new prototype glove designs are compliant with the performance specifications.

2. Aim

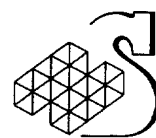
As identified by the Statement of Work (Reference B), "The aim of this project is to conduct a Human Factors analysis of two new prototypes of the temperate combat glove. This will be done via a field trial, where data will be acquired from soldiers performing various tasks, controlled and otherwise, through observation, questionnaires, and the conduct of focus groups." The results will be used to resolve the outstanding issues pertaining to the glove and finalize the design of the Temperate Combat Glove (TCG).



3. Scope

The temperate combat glove is a one-piece glove (i.e. no insert) intended to provide the essential dexterity and abrasion protection in temperatures of 10°C to 35°C. It will also provide thermal protection in the cooler portion of this temperature range under conditions where the Cold Wet Weather Glove may be perceived to be too warm and the Lightweight Thermal Handwear may not offer sufficient abrasion protection. Although the TCG was designed to function as a light work glove, it was anticipated that it would provide sufficient tactility and dexterity to perform fine motor tasks such as weapons sighting.

This Human Factors evaluation trial included both controlled and uncontrolled testing of two glove designs. The gloves included variations of the fit and design (cut). An identical size criterion was given to each glove manufacturer. Base on this criterion, each manufacturer provided six sizes for this trial. Two different cuts (pique sewn and Reverse Gunn Cut) were used in the designs of the two gloves.



4. Method

4.1 Overview

The following description provides a general overview of the trial method. Further details are provided in subsequent sections. Testing consisted of both a controlled trial and uncontrolled trial.

4.2 Gloves

The following types of temperate gloves were tested:

- A Reverse Gunn Cut (Goatskin):** This glove is made of goatskin leather with a Reverse Gunn Cut design. There is an elastic suppression on the palmer side of the wrist, as well as an adjustable wrist strap and coupling device on the back of the wrist. The palm is fully reinforced. See Figure 1.

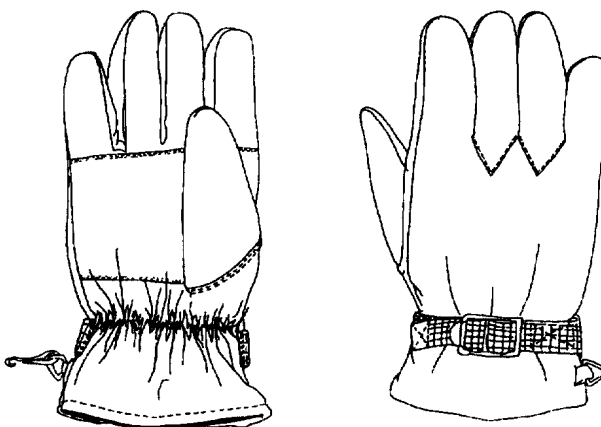
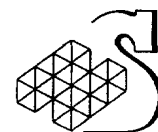


Figure 1: Temperate Combat Glove “A”



B Inseam (Pique) Sewn (Goatskin): This glove is made of goatskin leather with an Inseam (pique) Sewn Cut with fourchettes. There is an elastic suppression on the palmer side of the wrist, as well as an adjustable wrist strap and coupling device on the back of the wrist. The palm is fully reinforced. See Figure 2.

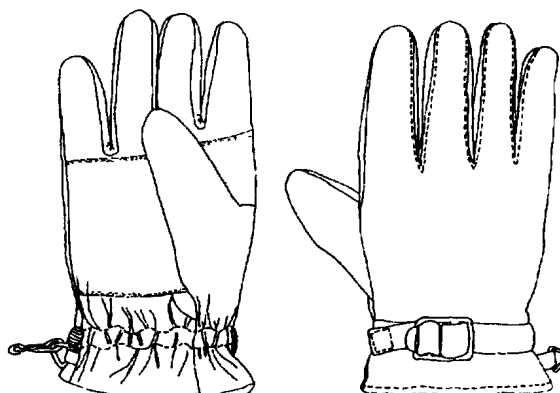


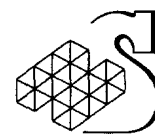
Figure 2: Temperate Combat Glove "B"

A number of essential and desirable features were recommended in the previous trial (see Reference A). Essential features are deemed to be so important that even if a potential TCG meets all other essential criteria and all desirable criteria, but fails to meet one essential criterion, that glove will be rejected. Desirable features are items perceived to add operational value. In Table 1, the essential and desirable features of each of the trial gloves are identified.

Table 1: Temperate Combat Glove Features

Features (E=Essential, D=Desirable)	TCG A	TCG B
E1. Goatskin Leather	✓	✓
E2. Partially Reinforced Palm (see D2)	✓	✓
E3. Short Cuff (approx. 1")	✓	✓
E4a. Reverse Gunn Cut	✓	X
E4b. Inseam Cut	X	✓
E5. Nylon or Nylon-Polypro Webbing Strap	✓	✓
E6. Elastic on the Palmer Side of the Wrist.	✓	✓
E7. No Interior Tabs.	✓	✓
E8. Coupling Device	✓	✓
D1. Water Resistant Finish	✓	✓
D2. Fully Reinforced Palm	✓	✓
D3. Move Strap Buckle towards Ulnar Edge of the Palm	X	X
D4. Cotton Webbing Strap	X	X
D5. Plastic Coated Metal Buckle	X	X
D6. Plastic Coated Metal Coupling Device	X	X
D7. Improved Fit	TBD*	TBD*

*TBD = To Be Determined



Both gloves had all of the essential features and some of the desirable features recommended in the previous study. The gloves had different styles of cut. In addition, the sizing and fit provided by the gloves is investigated in further detail in the trial. This trial was conducted to ensure that these gloves (and corresponding features) are compliant with HF performance requirements.

4.3 Participants

Thirty-six regular force soldiers were selected for specific hand sizes from Whiskey Battery at CFB Gagetown and were given temperate combat gloves. Gloves were fitted and issued by DCIEM between August 3-5, 1999. Twenty-four participants received both types of gloves and were instructed to alternate the gloves each other day. Five participants received only the A glove. Seven participants received only the B glove.

Twenty-one participants took part in the controlled portion of the trial. For selected tests in the trial, participants were organized into two groups each with 10-11 soldiers. Each group was balanced for hand size, gender, and MOC, so that each group was as similar as possible (i.e. matched groups). A senior NCO was assigned to each group to assist in trial organization and administration. These two NCOs were not participants in this trial. A Human Factors observer was also assigned to work with each Section for the purposes of data collection and focus group discussions.

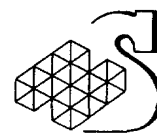
4.4 Uncontrolled Trial

From the time of issue (August 3-5, 1999) to the time of the controlled trial (November 5, 1999), participants issued only one pair of gloves had an opportunity to expose one glove to 95 days of operational use, and half that time for those issued two pair. All participants were asked to complete a Session Questionnaire (see Annex J) to assess the performance of the glove over the uncontrolled trial period. This data was collected primarily to assess performance criteria requiring extended operational use (fit (change in fit), protection, durability, and maintainability).

4.5 Controlled Trial

A two-day field trial was undertaken at CFB Gagetown over the period of November 4-5, 1999. Participants issued two pairs of gloves were required to undertake a battery of Human Factors tests while wearing the different temperate glove conditions in a repeated measures design. Due to time constraints, fewer tests were selected from the performance test methods. There were fewer clinical and compatibility tests, and no FIBUA or section attacks.

During each test, the order of conditions was balanced among participants. Human Factors tests included assessments of fit, accessibility, adjustability, compatibility, performance of clinical, military and battle tasks, thermal and physical comfort, durability, and user acceptance. Data collection included questionnaires, focus groups, performance measures and HF observer assessments.



4.6 Data

Data collection focused on the following HF criteria. Test procedures are described in more detail in Annex A and summarized in the following sections.

1. Fit
2. Accessibility / Adjustability
3. Compatibility (wpn, eqpt, clothing)
4. Vehicle Compatibility
5. Task Performance (obstacles and grenade throw)
6. Battle Task Performance (fire and movement and defence)
7. Clinical Hand Tests
8. Thermal Comfort
9. Physical Comfort
10. Durability / Protection / Maintainability
11. User Acceptance

Participants rated the acceptability of various items on the following seven-point scale (Figure 3).

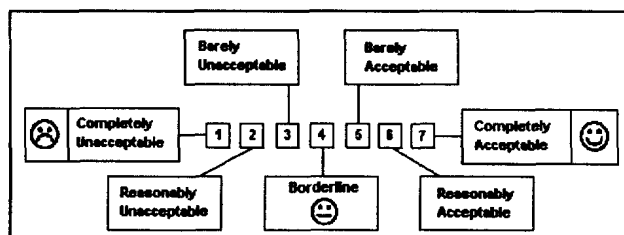


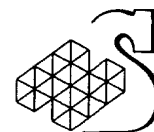
Figure 3: Standard Seven-Point Rating Scale of Acceptance

4.6.1 Fit

The two glove types were constructed in 6 sizes (see Table 2);

Table 2: Glove Sizing

Size	DII Length (mm)	Palm Width (mm)
1	60-65	72.5-85
2	65-70	72.5-85
3	65-70	85-97.5
4	70-75	75-87.5
5	70-75	87.5-100
6	75-80	85-97.5



Following an extensive briefing and demonstration of fit, participants were measured for critical anthropometric dimensions. Each participant's right hand was measured with a digital scan on a flatbed scanner. Derived measurements included hand length, DII length, and palm breadth. Manual measurements of DII P.I girth, palm girth, and DII length, and palm breadth were taken for verification of scanned measurements. Participants were then required to don each size of each glove type and perform sample finger manipulation and grasping tasks (e.g. C7 Magazine Load, touch fingertips, fist clench). Upon completion of adjustment and fitting, participants completed a Fit Questionnaire (see Annex B). HF observers evaluated the ease of fitting and the overall acceptability of the fit of each size of each type of glove.

In the previous TCG study (see Reference A), the three glove sizes provided did not provide an acceptable fit for all participants. As a result, small hands were not represented and large hands were under-represented. This trial was intended to include a representation of hands with smaller or larger hand measures closer to the extremes of the 95% confidence ellipse to help ensure a broad range of representative hand sizes would be addressed.

4.6.2 Accessibility / Adjustability

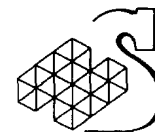
Participants were required to don and doff the temperate gloves and perform any adjustments required to ensure that the best fit was achieved. Participants rated the ease with which the gloves could be donned, adjusted, and doffed. Participants also rated the adjustability of the cuff closure to protect against entry of materials. HF observers evaluated the ease of accessibility and adjustment. Detailed accessibility and adjustability test procedures are provided in Annex A.

4.6.3 Compatibility

Compatibility with clothing, equipment and weapons was evaluated in static test stands. Participants were divided into smaller groups to perform the required tests and associated drills. HF observers collected compatibility measurement data and participant ratings. Each participant was evaluated separately under the close observation of the HF observer. The compatibility test items are listed in Table 3. Detailed compatibility test procedures are provided in Annex A.

Table 3: Compatibility Test Items

Test Stand	Item
Clothing	C4 Mask (and Carrier) Load Carriage Vest (Tactical Assault Vest) 82 Pattern Webbing
Weapons	C7A1 Rifle C7 magazine load C9A1 LMG M67 Grenade M72 SRAAW 84 mm Carl Gustav
Equipment	Jerry Cans (carry)



Participants were required to rate the compatibility of each glove condition with each of the selected weapons, equipment, and clothing combinations at each test stand. Participant ratings were collected in favour of performance timings for military task tests. HF observers measured critical dimensions and noted instances of compatibility clash and any accommodation required.

4.6.4 Vehicle Compatibility

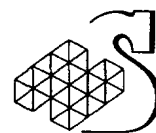
All temperate combat glove conditions were evaluated for compatibility with select infantry vehicles: (e.g. Bison or MLVW). The order of conditions was balanced. Specific evaluations included:

- a) **Ingress/Egress:** Participants were required to rate the ease of ingress and egress through vehicle hatches and doors. HF observers evaluated soldiers entering and exiting vehicles for any compatibility clash.
- b) **Vehicle Operation:** Driving performance was evaluated using simulated tasks required for vehicle operation. Simulated tasks included starting the engine, changing gears, operating windows and locks, and operating switches and control devices. Participants were required to rate the ease of vehicle operation in each condition. HF observers evaluated participants during vehicle operation for any compatibility clash.

4.6.5 Task Performance

Glove effects on performance of military tasks were evaluated for selected activities. At the completion of the obstacle course and grenade throw for each condition, participants were required to complete an Obstacle and Tasks Questionnaire (see Annex D).

- a) **Obstacle Course:** The following obstacles were undertaken consecutively as part of a single course:
 - Rope Climb:** Climbed and descended a rope to a height of approximately 6 feet.
 - Hand-Over-Hand Obstacle:** Moved hand-over-hand across bars spaced approximately 1½ feet apart with feet suspended from the ground.
 - Ladder Obstacle:** Ascended a 10m ladder, straddled and traversed the top bar, then descended the ladder to the ground.
 - Crawl:** Performed a Leopard crawl.
 - Wall Obstacle:** Ran 3m and climbed (unassisted) over a 2.4m high wall.
 - Over and Under Obstacle:** Climbed over and under five successive poles mounted 0.5 and 1.0 meter from the ground.
 - Mouse Hole Obstacle:** Crawled through a square, concrete mouse hole shaft for 1m and climbed over and under three successive poles mounted 0.5m, 1.0m, & 0.5m above ground.
- b) **Grenade Throw:** Participants threw a dummy grenade into a target circle (6 meter diameter) from a prone position at a distance of 15 meters. Participants indicated a performance rating score for each condition.



4.6.6 Battle Task Performance

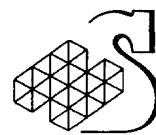
Several combat activities were combined to perform different battle tasks. Temperate glove design effects on soldier performance were evaluated for two battle tasks: Rifle Range and Preparation of a Defensive Position. Participant performance ratings and HF observer assessments were collected following each task. Fire and Movement and FIBUA House Clearing were not conducted in this field trial due to time constraints.

- a) **Rifle Range:** Two relays of 10-11 soldiers performed rifle range tasks with live ammunition. The tasks included 26 rds per glove: 2 rds warming, 5 rds prone, 5 rds kneeling, 5 rds standing, and 9 rds rapid fire. Magazines were changed between firing postures. At the completion of the rifle range tasks for each glove condition, participants were required to complete a Range Task Questionnaire (see Annex E).
- b) **Preparation of a Defensive Position:** This battle task ensured participants were required to fill and move sandbags (see Annex A for detailed test procedures of the sandbag drill). Participants rated their effectiveness in all glove conditions. HF observers evaluated the speed and manipulation effects of all temperate glove types.

4.6.7 Clinical Hand Manipulation Tests

Clinical tests were performed to test the degree to which the gloves affect a soldier's performance of hand tasks involving fine motor and gross motor finger manipulation. Participants undertook a battery of clinical tests of grip, tactility and dexterity. A repeated measures design was used with the order of gloves balanced among participants for each test. Baseline tests included a barehanded condition. Performance timings and participant ratings were taken following each test with each glove condition. The clinical hand manipulation test items are listed below and detailed test procedures are provided in Annex A.

- a) **Minnesota Manual Dexterity Test (Gross Manual Dexterity)**
- b) **Purdue Pegboard Assembly (Fine Finger Dexterity and Tactility)**
- c) **Hand Grip Strength Test (Grip Strength)**
- d) **Two-Point Discrimination (Tactility)**



4.6.8 Thermal Comfort

The thermal performance of each glove condition was evaluated. Following each battle task, participants were required to complete a Comfort Questionnaire (see Annex F). This questionnaire comprised drawings of the front and backsides of the hand. Participants were required to indicate the location of any heat build-up and rate the amount of thermal discomfort using the five point rating scale provided. Meteorological records of the temperature and relative humidity for each trial day were collected from the base airfield upon completion of the trial.

4.6.9 Physical Comfort

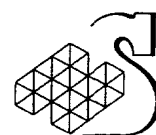
Following each battle task, participants were required to complete a Comfort Questionnaire (see Annex F). This questionnaire comprised drawings of the front and backsides of the hand. Participants were required to indicate the body location and rate the extent of discomfort using the five point rating scale provided. Discomfort included, but was not limited to, contact irritation or pressure points. HF staff investigated any reports of discomfort through interviews with affected participants.

4.6.10 Durability / Protection / Maintainability

The ease and effectiveness with which a participant could effect minor repairs and clean in the field were evaluated through observations, focus group discussion, and questionnaire ratings. Participants completed a Session Questionnaire (see Annex J) following 95 days of operational use. All repairs were logged and reviewed for durability issues. Suitability for field cleaning was evaluated in the field as appropriate. All gloves were inspected for wear at the completion of the trial. Exposure to various substances (i.e. deet, naphtha, weapon solvent, cam stick, gas, grease, antifreeze, RSDL) and the associated effects on the glove were evaluated during focus group discussions.

4.6.11 User Acceptance:

To assess user acceptance, participants were required to rate their overall acceptance of each temperate glove condition, including their perceived level of functionality, usability, and the general appearance using the Exit Questionnaire (see Annex G).



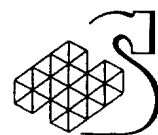
4.7 Trial Schedule and Data Collection Methods

Table 4 below outlines the two-day trial schedule.

Table 4: Trial Schedule

DAY 1(November 4, 1999)	Estimated Timing
Initial Brief	9:00 – 9:30
Fit Accessibility & Adjustability	9:30 – 1:00
Clinical Tests <ul style="list-style-type: none"> • Minnesota Manual Dexterity Turning (Dexterity) • Purdue Pegboard Assembly (Dexterity) • 2 Point Discrimination (Tactility) • Hand Grip Dynamometer (Grip) 	9:30 – 1:00
	Lunch 1:00-1:30
Compatibility Tests (Weapons) <ul style="list-style-type: none"> • C7 magazines • 4 x M72 • 4 x 84mm • 4 x C9 	1:30-3:00
Compatibility Tests (Clothing & Equipment & Vehicles) <ul style="list-style-type: none"> • NBC Mask • LCV (TAV) • 82 Pattern Web • Jerry Can • Bison or MLVW 	3:00-5:00
DAY 2 (November 5, 1999)	Estimated Timing
Issue C7s and C9s and travel to range.	7:00-7:30
Rifle Range	7:30-10:00
Obstacle Course / Grenade Throw Defensive Position (Thermal and Physical Comfort)	10:00-12:00
	Lunch 12:00-1:30
Exit Questionnaire Criteria Importance Questionnaire Features Questionnaire Focus Group	1:30-4:00

Data collection included task timings, participant ratings, questionnaire ratings, and focus group comments. This section describes the briefings, questionnaires and focus groups used in the trial. Comfort Questionnaires (Thermal and Physical) are detailed in sections 4.6.8 and 4.6.9 respectively.



4.7.1 Initial Briefing

Initially, participants were welcomed and introduced to the trial team. Participants were briefed on the trial schedule and data collection methods (i.e. questionnaires, focus groups, etc.). Questionnaire briefings explained the standard rating scale, the data scoring methods and rules of questionnaire completion. All glove conditions were introduced. A Session Questionnaire (see Annex J) was administered to each participant to obtain acceptance ratings for the gloves performance over the uncontrolled trial period. Participants absent from the controlled portion of the trial were asked by a trial officer to complete a Session Questionnaire on their own time.

4.7.2 Exit Questionnaire and Focus Group

An Exit Questionnaire (see Annex G) was issued to participants at the completion of all the test stands. Participants used the standard seven-point rating scale of acceptance to rate each glove condition related to each HF performance specification. This provided an opportunity for participants to provide a comparative rating between gloves. A focus group discussion was held following the completion of the questionnaire.

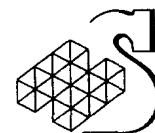
4.7.3 Criteria Importance Questionnaire and Focus Group

Participants were issued a Criteria Importance Questionnaire (see Annex H) at the completion of all test stands. A seven-point rating scale of importance (Of no importance, Of slight importance, Of little importance, Of some importance, Moderately important, Very important, and Extremely important) was used by participants to rate the importance of a number of different criteria related to the HF performance specifications for gloves. A focus group discussion was held following the completion of the questionnaire.

4.7.4 Features Questionnaire and Focus Group

Participants were required to rate the suitability of temperate combat glove design features using a Features Questionnaire (see Annex I). Features were discussed in detail during the Exit Focus Group to identify any concerns and suggestions for improvement regarding various TCG features. Features included:

- Type of Material (goatskin leather)
- Type of Cut (Reverse Gunn Cut & Inseam Sewn Cut)
- Cuff Length
- Wrist Strap Material
- Wrist Strap Position
- Buckle (Glove A or B)
- Elastic Wrist Strap
- Reinforced Palm
- Water Resistant Finish
- Coupling Device



5. Results & Discussion

This section presents the results of the Human Factors evaluation of the temperate combat glove conditions. The compliance or non-compliance with Human Factors Performance Specifications, criteria importance, glove features and focus group discussions are discussed in the following subsections.

5.1 Human Factors Performance Specifications

This section describes the test stand results for each of the HF criteria. On the seven-point rating scale of acceptance, ratings of “acceptable” are defined as ratings greater than or equal to 4 (“borderline”). To facilitate ease of comparisons between glove conditions, participant ratings that were rated as “acceptable” to less than 80% of participants are highlighted with shading.

A T-test for dependent measures was undertaken for all questionnaire acceptability scale and performance results. Significant differences are identified at $p < 0.05$.

For each HF performance specification, non-compliant items are identified with an “X”. Items compliant with the HF performance specification are indicated with a “✓”.

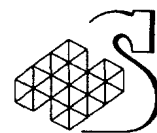
5.1.1 Fit

Human Factors Performance Specification	A	B
Fit: From a representative anthropometric sample of the CF LF population (males and females), most soldiers (80% or greater) shall rate the glove fit as acceptable.	X	X

The results from the questionnaires related to fit acceptance are described in Table 5 below. From the six sizes available, participants selected a glove of best fit and then rated the acceptability of the glove fit on a seven-point rating scale of acceptability. Most soldiers (80% or greater) rated the fit as acceptable for both glove conditions.

Table 5: Fit Acceptance Ratings

	User Acceptance Rating ≥ 4	
	A	B
Session Q: Overall Fit (n=21A, 20B)	86%	90%
Session Q: Overall Fit (n=21)	86%	91%
Exit Q: Fit (n=17)	88%	88%



Although most soldiers rated the glove fit as acceptable, the soldiers were not representative of the CF Land Forces population. To indicate how well the trial participants represented the entire CF Land Forces population, a plot of Digit II length versus palm breadth is provided in Figure 4. This plot includes measures taken from 24 participants that received a pair of both glove conditions. The TCG participants' measurements lacked representative small and large hand measures, particularly those with longer fingers. Because the trial participants did not completely represent the CF Land Forces population, the results were non-compliant with the fit acceptance HF performance specification.

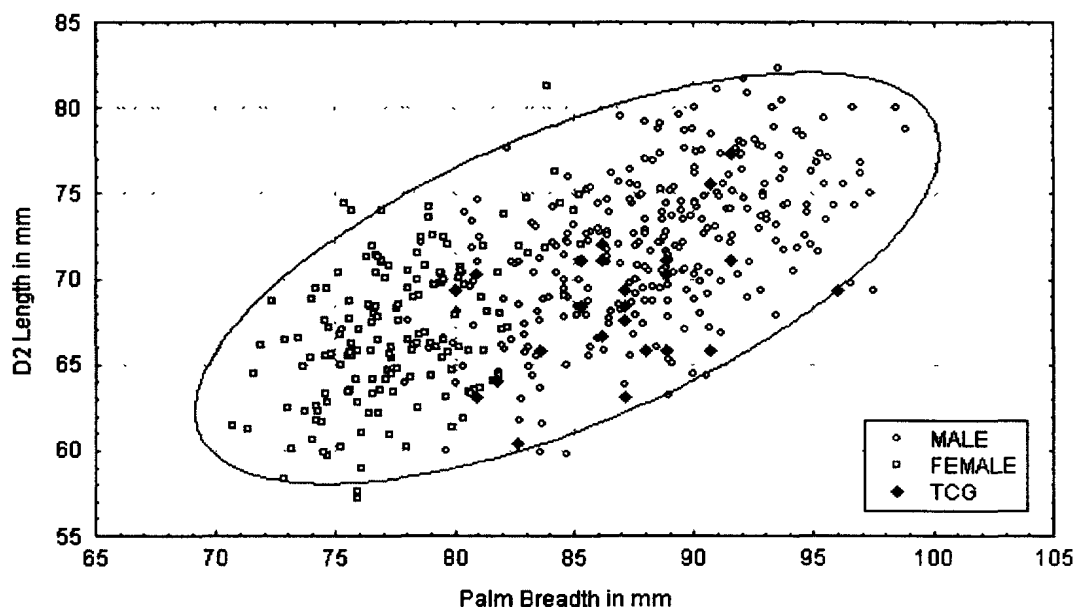


Figure 4: Temperate Combat Glove Participant Anthropometric Data Compared to the Entire Canadian Forces Land Force.

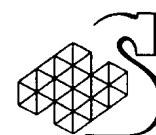
Although greater than 75% of participants rated each measure acceptable (≥ 4) for comfort, Session Questionnaire results indicated that the gloves were too large or too small on some dimensions. Dimensions rated too large or too small by more than 20% of participants are indicated below.

None of the dimensions for glove B were rated as too small (by more than 20% of participants). For glove A, participants indicated that the following dimensions were too small;

- Finger Length (33% of participants)
- Palm Length (24% of participants)
- Wrist Length (48% of participants)

For glove A, participants indicated that the following dimensions were too big;

- Finger Girth (43% of participants)
- Thumb Length (29% of participants)
- Thumb Girth (43% of participants)



For glove B, participants indicated that the following dimensions were too big:

- Finger Girth (24% of participants)
- Thumb Length (33% of participants)
- Thumb Girth (29% of participants)

Greater than 80% of participants rated the dimensions of palm breadth, palm girth and wrist girth as “OK” for both glove conditions.

5.1.2 Changes in Fit

Human Factors Performance Specification	A	B
Fit: The fit and fit adjustments of the glove must not be significantly degraded by operational use over a period of 90 days. Most soldiers (80% or greater) shall rate changes in fit as acceptable.	✓	✓

The results from the questionnaires related to acceptance of changes in fit are described in Table 6 below. The fit and fit adjustments of the gloves were assessed for a 95 day trial period. Results indicate that both glove conditions were compliant with the HF performance specification. Most soldiers (80% or greater) rated the changes in glove fit as acceptable.

Table 6: Changes in Fit Acceptance Ratings

	User Acceptance Rating ≥ 4	
	A	B
Session Q: Change in Fit (n=21)	91%	91%

For glove A, 86% of participants indicated that the change in Fit was “OK”. However, for glove B, 24% of participants indicated that the change in fit was “Too Big”. This indicates that glove B may have been more prone to noticeably stretch over the course of the trial period.

5.1.3 Weapons Compatibility

Human Factors Performance Specification	A	B
Weapons Compatibility: Most soldiers (80% or greater) shall rate the compatibility with weapons as acceptable in temperate environments.	✓	✓

The results from the questionnaires related to weapons compatibility are described in Table 7 below. Compatibility with weapons were rated following weapons compatibility drills (tests), range performance drills, and on the Session and Exit Questionnaires. Results indicate that both glove conditions were compliant with the HF performance specification. Most soldiers (80% or greater) rated the compatibility with weapons as acceptable in temperate environments.

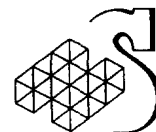


Table 7: Weapons Compatibility Acceptance Ratings

	User Acceptance Rating ≥ 4	
	A	B
Session Q: Weapons Compatibility (n=20A, 21B)	90%	95%
Weapons Compatibility Test: 84mm	95%	100%
Weapons Compatibility Test: M72	100%	100%
Weapons Compatibility Test: C6/C9	94%	94%
Task Q: Range - Weapon Handling	100%	100%
Task Q: Range - Weapon Firing	100%	100%
Task Q: Range - Weapon Sighting	95%	94%
Task Q: Range - Handling Mags/ Ammo	85%	95%
Task Q: Range - Load/Unload Mags	95%	100%
Task Q: Obstacles and Tasks - Grenade Handling/Throw	95%	100%
Exit Q: Weapons Compatibility (n=17)	94%	88%

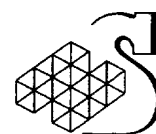
5.1.4 Equipment Compatibility

Human Factors Performance Specification	A	B
Equipment Compatibility: Most soldiers (80% or greater) shall rate the compatibility with equipment as acceptable in temperate environments.	✓	✓

The results from the questionnaires related to equipment compatibility are described in Table 8 below. Compatibility with equipment was rated following equipment compatibility drills (tests), and on the Session and Exit Questionnaires. Results indicate that both glove conditions were compliant with the HF performance specification. Most soldiers (80% or greater) rated the compatibility with equipment as acceptable in temperate environments.

Table 8: Equipment Compatibility Acceptance Ratings

	User Acceptance Rating ≥ 4	
	A	B
Session Q: Equipment Compatibility (n=20A, 21B)	90%	95%
Exit Q: Equipment Compatibility (n=17)	100%	100%
Equipment Compatibility Test: Jerry Cans	100%	100%



5.1.5 Tactility Performance

Human Factors Performance Specification	A	B
Tactility: Performance of Tactility tests shall not be statistically ($p < 0.05$) worse than the barehanded condition.	✓	✓

The tactility test (Two-Point Discrimination Tactility Tests (see Annex A)) involved the detection of two small metal prongs, separated by varying distances, on the tip of the index finger. A lower score corresponds to a smaller two-point discrimination distance and better tactility. A T-test for dependent measures was conducted and the results, including the mean, standard deviations, and p-values, are provided in Table 9 below. Results indicate that both glove conditions were compliant with the HF performance specification. Both gloved conditions did not perform significantly worse ($p < 0.05$) than the barehanded condition.

Table 9: Tactility Performance

	Two- Point Discrimination Gloved		Two-Point Discrimination Barehanded		p
	Mean	s.d.	Mean	s.d.	
Glove A	2.9mm	0.6mm	3.0mm	0.5mm	0.49
Glove B	3.0mm	0.7mm	3.0mm	0.5mm	0.75

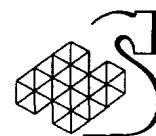
5.1.6 Tactility Acceptance

Human Factors Performance Specification	A	B
Tactility: In temperate conditions, most soldiers (80% or greater) shall rate the overall tactility as acceptable.	✓	✓

The results from the questionnaires related to tactility are described in Table 10 below. Tactility was rated following the obstacles and tasks and on the Session and Exit Questionnaires. Results indicate that both glove conditions were compliant with the HF performance specification. Most soldiers (80% or greater) rated the overall tactility as acceptable.

Table 10: Tactility Acceptance Ratings

	User Acceptance Rating ≥ 4	
	A	B
Task Q: Obstacles and Tasks – Tactility (n=19A, 18B)	95%	95%
Session Q: Tactility (n=20A, 21B)	90%	86%
Exit Q: Tactility (n=17)	88%	94%



5.1.7 Gross Motor Dexterity Performance

Human Factors Performance Specification	A	B
Dexterity (Gross Motor): Performance of Gross Motor Manual Dexterity tests shall not be statistically ($p < 0.05$) worse than the barehanded condition.	X	X

The gross motor dexterity test included a modified version of the Minnesota Manual Dexterity Turning Test (see Annex C). This is a hand dexterity test that involved lifting blocks out of holes, turning them over and replacing the blocks into the holes. Participants performed the test from a standing posture. The best time of two repetitions was used to assess performance.

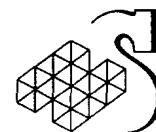
Better performance was indicated by less time to complete the task. A T-test for dependent measures was conducted and the results, including the mean, standard deviations, and p-values, are provided in Table 11 below. Results indicate that both glove conditions were non-compliant with the HF performance specification. Both glove conditions performed statistically worse ($p < 0.05$) than the barehanded condition.

Table 11: Gross Motor Dexterity Performance

	Minnesota Manual Dexterity Test Gloved		Minnesota Manual Dexterity Test Barehanded		P
	Mean	s.d.	mean	s.d.	
Glove A	55.1 sec	5.3 sec	48.6 sec	4.9 sec	<0.001
Glove B	60.6 sec	6.5 sec	48.6 sec	4.9 sec	<0.001

Although performance, based on the Gross Motor Manual Dexterity results, was statistically ($p < 0.05$) worse than the barehanded condition, comparison of results to previous studies indicated that the mean values of this study were not appreciably different. In the Human Factors Evaluation of Prototype Temperate Combat Gloves (see Reference A), the time differences of less than 12.5 seconds were not significantly different than the barehanded baseline (46 ± 3.6 seconds). However, time differences of less than 12.5 seconds [6.5 seconds (Glove A) and 12 seconds (Glove B)] were found to be statistically significant in this study. This was due, in part, to the smaller Sum of Squares Error and increased sensitivity resulting from fewer conditions being tests (i.e. 2 gloves types rather than 6). In other words, performance was statistically worse in the current trial, but not worse in practical or functional terms.

Caution should be exercised with this performance specification due to the fact that it was based on a repeated measures analysis of seven glove conditions (six gloves and a barehanded condition). It is recommended that future bid evaluations including less than six glove conditions should use a different definition of this Human Factors Performance Specification based on the results of this study and the Human Factors Evaluation of Prototype Temperate Combat Gloves (see Reference A). A recommended new wording might be:



- A. **“Dexterity (Gross Motor):** Performance of Gross Motor Manual Dexterity tests shall be equal to or better than the current in-service combat glove (or Temperate Combat Glove)”; or
- B. **“Dexterity (Gross Motor):** Performance of Gross Motor Manual Dexterity tests shall not exceed 125% of the performance (speed) obtained in the barehanded condition.”

The results of the original Human Factors Evaluation of Prototype Temperate Combat Gloves and the current trial are provided in the Tables 12 and 13 below. These results indicate (shaded) the gloves that exceeded 125% of the performance (speed) obtained in the barehanded condition.

Table 12: Results of Original Human Factors Evaluation of Prototype Temperate Combat Gloves

	Minnesota Manual Dexterity Test Gloved	% of Barehanded Performance	p
Glove A	70.6 sec	153%	<0.001
Glove B	54.4 sec	118%	0.208
Glove C	58.8 sec	128%	0.008
Glove D	50.2 sec	109%	0.891
Glove E	52.7 sec	115%	0.484
Glove Shell	59.9 sec	130%	0.003
Barehanded	46.0 sec	100%	NA

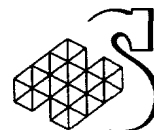
Table 13: Results of Human Factors Evaluation of Prototype Temperate Combat Gloves

	Minnesota Manual Dexterity Test Gloved	% of Barehanded Performance
Glove A	55.1 sec	113%
Glove B	60.6 sec	125%
Barehanded	48.6 sec	100%

Table 12 indicates that gloves A, C and the glove shell in the original evaluation all exceeded 125% of the performance (speed) obtained in the barehanded condition. Failure of the A, C and glove shell to meet the performance specification is consistent with the results of the original performance specification when performance was related to the barehanded condition. In the current evaluation, none of the gloves exceeded 125% of the performance (speed) obtained in the barehanded condition. Using this performance specification, both gloves would be compliant.

5.1.8 Fine Motor Dexterity Performance

Human Factors Performance Specification	A	B
Dexterity (Fine Motor): Performance of Fine Finger Manual Dexterity tests shall be equal to or better than the current in-service combat glove (or Temperate Combat Glove).	✓	✓



The fine motor dexterity test included a modified version of the Purdue Pegboard Assembly Test (see Annex A). This is a speed and accuracy test of fine finger dexterity that involved lifting pegs or parts from cups with both hands, and placing or assembling them on the pegboard. Better performance was indicated by a larger number of pegs or pieces assembled in a limited amount of time.

A T-test for dependent measures was conducted and the results, including the mean, standard deviations, and p-values, are provided in Table 14 below. Results indicate that both glove conditions were compliant with the HF performance specification. Both glove conditions performed significantly better ($p < 0.05$) than the in-service combat glove condition.

Table 14: Fine Motor Dexterity Performance

	Purdue Pegboard Assembly Test Gloved		Purdue Pegboard Assembly Test with current in-service combat glove		p
	Mean	s.d.	mean	s.d.	
Glove A	21.0 parts	3.8 parts	13.5 parts	4.7 parts	<0.001
Glove B	20.2 parts	4.5 parts	13.5 parts	4.7 parts	<0.001

5.1.9 Dexterity Acceptance

Human Factors Performance Specification	A	B
Dexterity: In temperate conditions, most soldiers (80% or greater) shall rate the overall dexterity as acceptable.	✓	✓

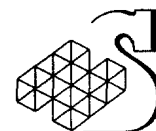
The results from the questionnaires related to dexterity are described in Table 15 below. Dexterity was rated following the obstacles and tasks and on the Session and Exit Questionnaires. Results indicate that both glove conditions were compliant with the HF performance specification. Most soldiers (80% or greater) rated the overall dexterity as acceptable.

Table 15: Dexterity Acceptance Ratings

	User Acceptance Rating ≥ 4	
	A	B
Task Q: Obstacles and Tasks - Dexterity (n=19A, 18B)	95%	83%
Session Q: Dexterity (n=21)	86%	91%
Exit Q: Dexterity (n=17)	94%	88%

5.1.10 Protection

Human Factors Performance Specification	A	B
Protection: Following 90 days of operational use, most soldiers (80% or greater) shall rate the protection of the glove as acceptable.	✓	✓



The results from the questionnaires related to protection are described in Table 16 below. The protection of the gloves was assessed over a 95 day trial period. Results indicate that both glove conditions were compliant with the HF performance specification. Most soldiers (80% or greater) rated the protection of the gloves as acceptable.

Table 16: Protection Acceptance Ratings

	User Acceptance Rating ≥ 4	
	A	B
Session Q: Protection (n=21)	86%	95%
Exit Q: Protection (n=17)	88%	94%

5.1.11 Grip Performance

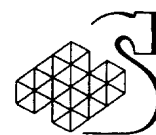
Human Factors Performance Specification	A	B
Grip: In temperate conditions, hand grip force exerted when gloved, for both dominant and non-dominant hands, shall exceed 80% of the hand grip force measured in the barehanded condition.	X	X

Table 17 shows the results of the dominant and non-dominant hands for the Grip Strength tests and the percentage of participants that achieved at least 80% of their maximal grip strength. Results indicate that both glove conditions were non-compliant with the HF performance specification. For glove A, 11% (dominant hand) and 16% (non-dominant hand) of participants did not exceed 80% of the hand grip force measured in the barehanded condition. For glove B, 5% (dominant hand) and 5% (non-dominant hand) of participants did not exceed 80% of the hand grip force measured in the barehanded condition.

Table 17: Grip Performance

	% of participants exceeding 80% of barehanded grip force	
	A	B
Hand Grip Strength Test (dominant hand)	89%	95%
Hand Grip Strength Test (non-dominant hand)	84%	95%

Further analyses indicated that all participants, with both glove conditions could exert at least 70% of the grip force measure obtained in the barehanded condition.



5.1.12 Grip Acceptance

Human Factors Performance Specification	A	B
Grip: In temperate conditions, most soldiers (80% or greater) shall rate the overall grip strength as acceptable.	✓	✓

The results from the questionnaires related to grip acceptance are described in Table 18 below. Grip was rated following the obstacles and tasks and on the Session and Exit Questionnaires. Results indicate that both glove conditions were compliant with the HF performance specification. Most soldiers (80% or greater) rated the overall grip strength as acceptable.

Table 18: Grip Acceptance Ratings

	User Acceptance Rating ≥ 4	
	A	B
Task Q: Obstacles and Tasks - Grip (n=19A, 18B)	100%	94%
Session Q: Grip (n=20)	85%	100%
Exit Q: Grip (n=17)	100%	100%

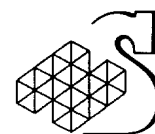
5.1.13 Physical Comfort

Human Factors Performance Specification	A	B
Physical Comfort: Most soldiers (80% or greater) shall rate glove comfort as acceptable.	✓	✓

The results from the questionnaires related to physical comfort are described in Table 19 below. Physical Comfort was rated following the obstacles and tasks and on the Session and Exit Questionnaires. Results indicate that both glove conditions were compliant with the HF performance specification. Most soldiers (80% or greater) rated the physical comfort as acceptable.

Table 19: Physical Comfort Ratings

	User Acceptance Rating ≥ 4	
	A	B
Task Q: Obstacles and Tasks - Physical Comfort (n=19A, 18B)	100%	94%
Comfort Q: Physical Comfort (n=19A, 18B)	95%	100%
Session Q: Physical Comfort (n=21)	100%	100%
Exit Q: Physical Comfort (n=17)	90%	95%



5.1.14 Durability

Human Factors Performance Specification	A	B
Durability: Following 90 days of operational use, most soldiers (80% or greater) shall rate the durability of the glove as acceptable.	✓	✓

The results from the questionnaires related to durability are described below. The durability of the gloves was assessed over a 95 day trial period. Results indicate that both glove conditions were compliant (with explanation) with the HF performance specification. Most soldiers (80% or greater) rated the durability of the gloves as acceptable. Some special considerations were applied for the acceptance ratings of glove A.

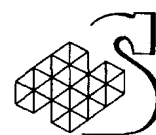
Table 20: Durability Acceptance Ratings

	User Acceptance Rating ≥ 4	
	A	B
Session Q: Durability (n=21A, 20B)	71%*	100%
Exit Q: Durability (n=17)	82%	88%

*Results of the Session Questionnaire indicated that some participants did not feel the durability of the glove A was acceptable over the duration of the user trial. Further investigation of the results of the Session Questionnaire (see Table 21) indicated that the lack of acceptance may have been related to the leather finish or the coupling device, both rated acceptable by less than 80% of participants. Following controlled tests, acceptance ratings for durability improved to 82% on the Exit Questionnaire. Comments indicated that the durability could be better assessed following exposure to the activities (e.g. digging, obstacles, weapons handling) performed during the controlled session. For this reason, the Exit Questionnaire results were viewed as a better reflection of durability issues.

Table 21: Session Questionnaire Results Related to Durability

Session Questionnaire (n=20-21)	User Acceptance Rating ≥ 4	
	A	B
Glove Design/Cut Durability	86%	100%
Cuff Durability	100%	100%
Wrist Strap Material Durability	100%	100%
Wrist Strap Buckle Durability	95%	100%
Wrist Strap Elastic Durability	95%	95%
Reinforced Palm Durability	95%	91%
Type of Leather Durability	91%	91%
Leather Finish Durability	76%	90%
Coupling Device Durability	62%	62%



5.1.15 Accessibility

Human Factors Performance Specification	A	B
Accessibility: Most soldiers (80% or greater) shall rate the doffing and donning of the gloves as acceptable in temperate conditions.	✓	✓

The results from the questionnaires related to accessibility are described in Table 22 below. Accessibility was rated following the accessibility test procedures and on the Session and Exit Questionnaires. Results indicate that both glove conditions were compliant with the HF performance specification. Most soldiers (80% or greater) rated the doffing and donning of the gloves as in temperate conditions.

Table 22: Accessibility Acceptance Ratings

	User Acceptance Rating ≥ 4	
	A	B
Session Q: Accessibility (n=21)	86%	91%
Accessibility Q: Overall Accessibility (n=21)	100%	100%
Accessibility Q: Donning Glove (n=21)	90%	95%
Accessibility Q: Doffing Glove (n=21)	90%	100%
Exit Q: Accessibility (n=17)	100%	100%

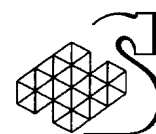
5.1.16 Adjustability

Human Factors Performance Specification	A	B
Adjustability: In temperate conditions, most soldiers (80% or greater) shall rate the adjustability of the gloves as acceptable.	✓	✓

The results from the questionnaires related to adjustability are described in Table 23 below. Adjustability was rated following the adjustability test procedures and on the Session and Exit Questionnaires. Results indicate that both glove conditions were compliant with the HF performance specification. Most soldiers (80% or greater) rated the overall adjustability as acceptable.

Table 23: Adjustability Acceptance Ratings

	User Acceptance Rating ≥ 4	
	A	B
Session Q: Adjustability (n=21)	95%	95%
Adjustability Q: Overall Adjustability (n=21)	100%	95%
Adjustability Q: Adjusting Wrist (n=21)	100%	95%
Exit Q: Adjustability (n=17)	100%	100%



5.1.17 Clothing Compatibility

Human Factors Performance Specification	A	B
Clothing Compatibility: Most soldiers (80% or greater) shall rate the compatibility with clothing as acceptable in temperate environments.	✓	✓

The results from the questionnaires related to clothing compatibility are described in Table 24 below. Compatibility with clothing was rated following clothing compatibility drills (tests), and on the Session and Exit Questionnaires. Results indicate that both glove conditions were compliant with the HF performance specification. Most soldiers (80% or greater) rated the compatibility with clothing as acceptable in temperate environments.

Table 24: Clothing Compatibility Acceptance Ratings

	User Acceptance Rating ≥ 4	
	A	B
Session Q: Clothing Compatibility (n=21)	100%	95%
Clothing Compatibility Test: NBC C4 Mask (Masking Drill)	100%	100%
Clothing Compatibility Test: Load Carriage (Tactical) Vest	100%	100%
Exit Q: Clothing Compatibility (n=17)	100%	100%

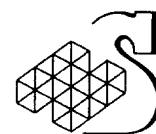
5.1.18 Task Performance – Defensive Position

Human Factors Performance Specification	A	B
Task Performance – Defensive Position: Most soldiers (80% or greater) shall rate the performance of the glove on Defensive Position tasks as acceptable in temperate environments.	✓	✓

The results from the questionnaires related to the task performance of defensive positions are described in Table 25 below. Defensive position task performance was rated following defensive position tasks and on the Exit Questionnaires. Results indicate that both glove conditions were compliant with the HF performance specification. Most soldiers (80% or greater) rated the performance of the glove on Defensive Position Tasks as acceptable in temperate environments.

Table 25: Defensive Position Task Performance Acceptance Ratings

	User Acceptance Rating ≥ 4	
	A	B
Task Q: Obstacles and Tasks – Task Performance - Defensive Position (n=17A, 18A)	100%	100%
Exit Q: Task Performance – Defensive Position (n=17)	87%	93%



5.1.19 Cuff Closure Adjustability

Human Factors Performance Specification	A	B
Adjustability (cuff closure): Most soldiers (80% or greater) shall rate the adjustability of the wrist closures to prevent the ingress of rain, dirt and sand as acceptable.	✓	✓

The results from the questionnaires related to cuff closure adjustability are described in Table 26 below. Cuff Closure adjustability was rated following the adjustability test procedures and on the Exit Questionnaires. Results indicate that both glove conditions were compliant with the HF performance specification. Most soldiers (80% or greater) rated the overall adjustability of the wrist closures to prevent the ingress of rain, dirt and sand as acceptable.

Table 26: Adjustability Acceptance Ratings

	User Acceptance Rating ≥ 4	
	A	B
Adjustability Q: Cuff Closure Protection (n=17)	86%	95%
Exit Q: Cuff Closure Protection (n=17)	94%	100%

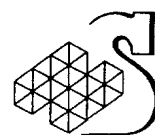
5.1.20 Task Performance – FIBUA / Fire & Movement

Human Factors Performance Specification	A	B
Task Performance – FIBUA / Fire & Movement: Most soldiers (80% or greater) shall rate the performance of the glove on FIBUA and Fire & Movement tasks as acceptable in temperate environments.	✓	✓

The results from the questionnaires related to the task performance of FIBUA / Fire and Movement are described in Table 27 below. FIBUA / Fire and Movement task performance was rated following Range tasks. No FIBUA or fire and movement tasks were directly performed. Range tasks were conducted to indirectly assess Fire and Movement tasks. Results indicate that both glove conditions were compliant with the HF performance specification. Most soldiers (80% or greater) rated the performance of the glove on FIBUA / Fire and Movement Tasks as acceptable in temperate environments.

Table 27: FIBUA / Fire & Movement Task Performance Acceptance Ratings

	User Acceptance Rating ≥ 4	
	A	B
Task Q: Range – Overall Performance of gloves on Range Tasks	95%	100%



5.1.21 Thermal Comfort

Human Factors Performance Specification	A	B
Thermal Comfort: Most soldiers (80% or greater) shall rate the thermal comfort of the gloves as acceptable after the following conditions: A. 30 minutes at a moderate work rate at 10°C (dry)	✓	✓

The results from the questionnaires related to thermal comfort are described in Table 28 below. Thermal Comfort was rated following the obstacles and tasks and on the Session and Exit Questionnaires. Results indicate that both glove conditions were compliant with the HF performance specification. Most soldiers (80% or greater) rated the thermal comfort as acceptable.

Table 28: Thermal Comfort Ratings

	User Acceptance Rating ≥ 4	
	A	B
Task Q: Obstacles and Tasks - Thermal Comfort (n=19A, 18B)	95%	100%
Comfort Q: Thermal Comfort (n=19A, 18B)	100%	100%
Session Q: Thermal Comfort (n=21)	90%	91%
Exit Q: Thermal Comfort (n=17)	88%	94%

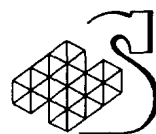
5.1.22 Maintainability

Human Factors Performance Specification	A	B
Maintainability: Following 90 days of operational use, most soldiers (80% or greater) shall rate the maintainability of the glove as acceptable.	✓	✓

The results from the questionnaires related to maintainability are described in Table 29 below. The maintainability of the gloves was assessed over a 95 day trial period. Results indicate that both glove conditions were compliant with the HF performance specification. Most soldiers (80% or greater) rated the maintainability of the gloves as acceptable.

Table 29: Maintainability Acceptance Ratings

	User Acceptance Rating ≥ 4	
	A	B
Session Q: Thermal Comfort (n=21)	100%	100%
Exit Q: Thermal Comfort (n=17)	100%	100%



5.1.23 Vehicle Compatibility

Human Factors Performance Specification	A	B
Vehicle Compatibility: Most soldiers (80% or greater) shall rate the compatibility with vehicles as acceptable in temperate environments.	✓	✓

The results from the questionnaires related to vehicle compatibility are described in Table 30 below. Compatibility with vehicle was rated following vehicle compatibility drills (tests), and on the Session and Exit Questionnaires. Results indicate that both glove conditions were compliant with the HF performance specification. Most soldiers (80% or greater) rated the compatibility with vehicles as acceptable in temperate environments.

Table 30: Vehicle Compatibility Acceptance Ratings

	User Acceptance Rating ≥ 4	
	A	B
Session Q: Vehicle Compatibility (n=21)	100%	95%
Vehicle Compatibility Test: LSVW Compatibility/Operation	100%	100%
Exit Q: Vehicle Compatibility (n=17)	100%	100%

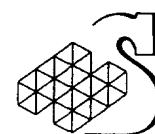
5.1.24 Task Performance - Obstacles

Human Factors Performance Specification	A	B
Task Performance – Obstacles: Most soldiers (80% or greater) shall rate the performance of the glove on obstacle tasks as acceptable in temperate environments.	✓	✓

The results from the questionnaires related to the task performance of obstacles are described in Table 31 below. Obstacles task performance was rated following obstacle tasks. Results indicate that both glove conditions were compliant with the HF performance specification. Most soldiers (80% or greater) rated the performance of the glove on obstacle tasks as acceptable in temperate environments.

Table 31: Obstacles Task Performance Acceptance Ratings

	User Acceptance Rating ≥ 4	
	A	B
Task Q: Obstacles and Tasks - Task Performance – Obstacles (n=19A, 18B)	95%	94%
Exit Q: Task Performance – Obstacles (n=15)	100%	100%



5.1.25 Water Resistance and Dryability

Human Factors Performance Specification	A	B
Water Resistance and Dryability: Performance with <u>wet</u> gloves shall not significantly degrade the dexterity in 80% of samples tested.	NA	
Water Resistance and Dryability: Performance with <u>dried</u> gloves shall not significantly degrade the dexterity in 80% of samples tested.	NA	

NA: Not Assessed in Trial. Gloves were not tested under wet conditions due to trial restraints.

Although water resistance and dryability were not directly tested in the trial, participants provided ratings of the gloves performance over the course of the trial (see Table 32).

Table 32: Obstacles Task Performance Acceptance Ratings

	User Acceptance Rating ≥ 4	
	A	B
Session Q: Water Resistance (n=21)	67%	76%
Exit Q: Dryability (n=17)	94%	88%
Exit Q: Water Resistance (n=17)	82%	88%

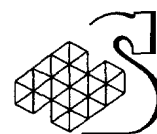
5.1.26 Appearance

Human Factors Performance Specification	A	B
Appearance: By its design and appearance, the gloves shall be perceived by most soldiers (80% or greater) to be appropriate and desirable for military wear.	✓	✓

The results from the questionnaires related to appearance are described in Table 33 below. Appearance was rated on the Session and Exit Questionnaires. Results indicate that both glove conditions were compliant with the HF performance specification. Most soldiers (80% or greater) rated the overall appearance as acceptable.

Table 33: Appearance Acceptance Ratings

	User Acceptance Rating ≥ 4	
	A	B
Session Q: Appearance (n=21)	100%	100%
Exit Q: Appearance (n=17)	94%	100%



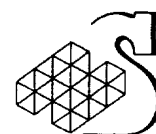
5.1.27 User Acceptance

Human Factors Performance Specification	A	B
User Acceptance Most soldiers (80% or greater) shall rate the overall acceptance of the gloves as acceptable.	✓	✓

The results from the questionnaires related to user acceptance are described in Table 34 below. User acceptance was rated on the Session and Exit Questionnaires. Results indicate that both glove conditions were compliant with the HF performance specification. Most soldiers (80% or greater) rated the overall user acceptance as acceptable.

Table 34: User Acceptance Ratings

	User Acceptance Rating ≥ 4	
	A	B
Session Q: Overall Acceptance (n=21)	91%	91%
Exit Q: Overall Acceptance (n=17)	94%	100%



5.2 Criteria Importance

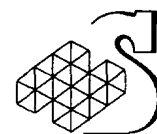
Participants were asked to rate the importance of the Human Factors performance criteria using a 7-point scale of importance. The seven-point scale of importance ranged from 1= Of no importance to 7= Extremely important. The HF performance criteria are listed in Table 35, ranked in order of importance.

Table 35: Criteria Importance Rankings

Rank	Item	mean	s.d.	n
1	Fit	6.8	0.4	18
2	Dexterity	6.8	0.5	18
3	Grip	6.4	0.8	18
4	Tactility	6.4	0.9	18
5	Durability	6.3	0.7	18
6	Protection	6.2	0.9	18
7	Weapon Compatibility	6.2	1.2	18
8	Physical Comfort	5.9	0.8	18
9	Water Resistance	5.9	1.0	18
10	Equipment Compatibility	5.7	1.4	18
11	Dryability	5.6	1.0	18
12	Thermal Comfort	5.5	1.0	18
13	Adjustability	5.3	0.8	18
14	Accessibility (don/doff)	5.2	0.9	18
15	Fire & Movement Performance	5.2	1.1	18
16	Maintainability	5.2	1.3	18
17	Cuff Closure Environmental Protection	5.1	1.2	18
18	Vehicle Compatibility	5.0	1.4	18
19	Preparation of Defensive Position Performance	4.8	0.8	18
20	FIBUA Performance	4.7	0.8	18
21	Clothing Compatibility	4.7	1.3	18
22	Grenade Throwing Performance	4.6	1.0	18
23	Obstacle Course Performance	4.1	1.1	18
24	Appearance	3.8	1.3	18

The top 10 criteria are consistent with the previous TCG trial (see Reference A) with the exception of water resistance (9) instead of accessibility (14). Participant comments indicated that accessibility was perceived to be less important because both gloves were relatively easy to don and doff as opposed to the previous TCG trial. In the previous TCG trial, some gloves had tabs (i.e. ends of retention straps) that scratched and cut the wrists causing physical discomfort when donning and doffing the gloves. Because the tabs were not present in the current trial, accessibility was easier and less importance was attributed to the ease of accessibility.

Compliance of the gloves with HF performance requirements for water resistance and dryability was not directly assessed in the current trial due to time constraints. The importance attributed by the participants to the criteria “water resistance” indicates that future Human Factors evaluations must endeavour to assess the HF performance requirements related to water resistance and dryability.



5.3 Features Questionnaire

Participants were asked to rate the acceptance of the various glove features using the 7-point scale of acceptance. The percentage of participants rating the features as acceptable (≥ 4) are indicated in Table 36.

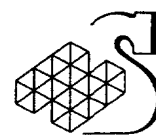
Table 36: Features Acceptance Ratings

Features	User Acceptance Rating ≥ 4	
	A	B
Material (Leather)	94%	94%
Type of Cut	77%	88%
Cuff Length	82%	88%
Wrist Strap Material	100%	94%
Wrist Strap Position	88%	100%
Buckle	94%	53%
Elastic Waist Strap	94%	100%
Reinforced Palm	100%	100%
Water Resistant Finish	88%	82%
Coupling Device	82%	65%

Most of the features were rated acceptable by greater than 80% of participants with the exception of glove A for type of cut (i.e. Reverse Gunn Cut), and glove B for the buckle and coupling device. More participants rated the cut of the B glove, the Inseam Sewn Cut, as more acceptable than the cut of glove A, the Reverse Gunn Cut. The preference for the Reverse Gunn Cut is discussed in more detail in the Focus Group Discussions (see 5.4.).

The buckle of glove B was rated unacceptable (<4) by 47% of participants. Participants indicated that the buckle on glove B came undone easily, especially when doffing the glove. In addition, the size of the buckle allowed the strap to easily come loose. A smaller buckle, like the buckle on glove A, was preferred.

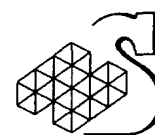
The coupling device on glove B was rated unacceptable (<4) by 35% of participants. The coupling device on both glove conditions appeared to be essentially identical. Participants commented that they did not like the coupling device provided. They perceived that it would not be sufficiently durable, especially in cold conditions. Participants indicated a plastic-coated metal would be preferable. All participants indicated that the provision of a coupling device was acceptable, given that it could be removed if desired.



5.4 Focus Group Discussions

Overall, 76% of the participants preferred glove A while 24% preferred the B glove. Glove A was preferred because the Reverse Gun Cut design did not have material at the fingertips that often interfered with dexterity and tactility. In addition, the material of glove A was perceived to be better because it was lighter (more pliable) which provided better tactility and thermal comfort at hotter temperatures. Glove A also had a better wrist strap buckle (slightly smaller) that was more secure (i.e. the strap had adequate resistance to prevent the strap from coming loose from the buckle).

Although a majority of participants liked glove A for the above reasons, they preferred the cut of the B glove. The Inseam Sewn Cut was preferred because it “fit” the hand better due to its three dimensional shape. Participants commented that the type of cut was better tailored to the hand. Participants also believed it portrayed a more professional and quality image. Glove B also had a slightly longer cuff that was beneficial for additional coverage and protection of the wrist from debris.



6.0 Conclusions

This section discusses the compliance of the gloves with the HF performance requirements. Other issues related to the type of cut, fit and extended use are also discussed. Direction is provided for future research efforts.

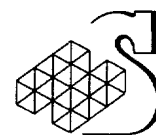
6.1 Compliance with HF Performance Requirements

The results indicated that both gloves were compliant with most of the HF performance requirements tested in this trial with the exception of Fit Acceptance, Gross Motor Dexterity Performance and Grip Strength Performance. Results for Fit Acceptance are discussed section 6.3. Results for the Gross Motor Dexterity Performance indicated that although performance of the Gross Motor Manual Dexterity test was statistically ($p < 0.05$) worse than the barehanded condition, comparison of results to previous studies indicated that the mean values of this study were not appreciably different. In other words, performance was statistically worse in the current trial, but not worse in practical or functional terms. It is recommended that future bid evaluations including less than six glove conditions should use a different definition of this Human Factors Performance Specification based on the results of this study and the Human Factors Evaluation of Prototype Temperate Combat Gloves (see Reference A). The following wording is recommended:

- **“Dexterity (Gross Motor):** Performance of Gross Motor Manual Dexterity tests shall be equal to or better than the current in-service combat glove (or Temperate Combat Glove)”; or
- **“Dexterity (Gross Motor):** Performance of Gross Motor Manual Dexterity tests shall not exceed 125% of the performance (speed) obtained in the barehanded condition.”

Given these new HF performance specifications, both glove conditions were compliant for gross motor dexterity performance.

Results for the Grip Strength performance indicated that not all participants were able to achieve at least 80% of their barehanded grip force. This may be attributed to sub-maximal grip efforts during the testing. This may also be attributed to the additional reinforced palm area. The HF performance criterion was based on gloves with partial or no reinforced palm. The glove conditions of the current trial had fully reinforced palms, which may have reduced the grip force that could be obtained. Further analyses indicated that all participants, with both glove conditions, could exert at least 70% of the grip force measure obtained in the barehanded condition. It is recommended that future bid evaluations including fully reinforced palms should use a different definition of this Human Factors Performance Specification based on the results of this study and the Human Factors Evaluation of Prototype Temperate Combat Gloves (see Reference A). The following wording is recommended:



- **Grip:** In temperate conditions, hand grip force exerted when gloved, for both dominant and non-dominant hands, shall exceed **70%** of the grip force measured in the barehanded condition.

6.2 Type of Cut

In terms of design only, participants preferred the Inseam Sewn Cut (glove B) to the Reverse Gunn Cut (Glove A). However, the Inseam Sewn Cut style should provide the functionality and benefits of glove A. All participants indicated that the ideal glove would be Inseam Sewn Cut and retain the benefits of glove A listed previously. These features are listed below:

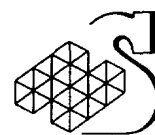
- Inseam Sewn Cut (provided the fingertips do not have material or seams that interfere with tactility and dexterity)
- Goatskin leather (like the A glove)
- Fully reinforced palm
- Short cuff (the length should be shorter than glove B but longer than the glove A)
- Strap and buckle system (like glove A's smaller-sized buckle)
- Coupling device (like glove A or more durable – possibly a plastic-coated metal)

6.3 Fit

Both gloves were non-compliant with the Fit Acceptance HF performance specification and must still be resolved. More than 80% of the participants included in this trial were able to achieve an acceptable overall fit. However, many individual components of the glove were rated as “too big” or “too small”. In addition, the sample population used in the trial lacked representation of large hands, small hands, and hands with long fingers. As a result, the trial was unable to assess if CF Land Forces personnel with such hand sizes are able to achieve an acceptable fit with the proposed 6-size system. A more representative sample of the CF Land Force population should be tested to ensure that the sizing system matches the actual hand dimensions of its intended users.

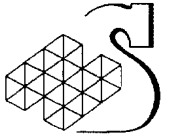
6.4 Extended Use

The uncontrolled portion of the trial allowed participants to assess the use of the temperate combat gloves over an extended period of time. This exposure was important to provide at least 90 days of normal operations to assess Durability, Protection and Maintainability. This extended use was not conducted in the previous study (see Reference A). Results indicated that following 90 days of operational use, most soldiers (80% or greater) rated the durability, protection, and maintainability of the temperate combat gloves as acceptable.

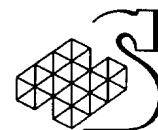


6.5 Future research

Given the results provided by this trial, the next phase of the Temperate Combat Glove project should be to have new prototype gloves produced and to evaluate these new prototypes in a User Acceptability Trial. Issues related to developing a working sizing system also require further research. Future assessments of Temperate Combat Gloves should integrate the recommended changes to the Gross Motor Dexterity and Grip HF performance criteria. The Human Factors performance criteria and test methods, as validated in the current study, should be used to support future acquisition decisions in the effort to select the best possible glove for the Canadian Land Forces.



ANNEX A:
Test Procedure



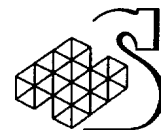
Accessibility and Adjustability

1. Set-up. Subject standing, facing the experimenter. Subjects have gloves donned.
2. Subject Instructions. "This is an accessibility test to determine how easily you can don and doff the gloves. First, you will doff the gloves. You must loosen the adjustments prior to removing the gloves. Next, you will don the gloves. You must tighten the adjustments once the gloves are donned. Please pay attention to your ability to don and doff the gloves as well as the adjustments as you will be asked to rate the acceptability.
3. Perform the doff and don twice.
4. Ask the subject for a rating and comments on their ability to doff and don the gloves (accessibility). Record any observations or comments.
5. Ask the subject for a rating and comments on their ability to adjust, tighten and loosen the gloves (adjustability). Record any observation or comments.
6. Ask the subject for a rating and comments on the ability of the wrist closures to prevent the ingress of snow, rain and cold air.

Minnesota Manual Dexterity Turning Test (Modified)

1. Set-up. Board lengthwise, 12 inches away from subject, filled with blocks (same colour side up).
2. Instructions to Subject/Practice. (Have subject demonstrate 1 row, plus beginning of second row in slow time as you speak). "This is also a speed test - to see how fast you can turn the blocks over. Do the back or top row farthest away from you first. Begin at your right and work to your left. Put your left hand on the block in the upper right hand corner of the board. Lift the block out of the hole. Turn it over and put it into the same hole with your left hand. Do the whole top row the same way. Go back along the 2nd row, but this time switching your hands (pick up with right, turn and put down with left hand). Same for the rest of the board.
3. 1st Timed Run. Have subject turn all blocks. Prompt them at the end of each row to switch hands. Time from your command "GO" until last block is seated into last hole in board. Record time in seconds. (Leave blocks as they are for next run)
4. 2nd Timed Run. Record time to turn all blocks in seconds.
5. Calculate mean performance time.

Note. If a test is "botched" part-way through the task (e.g., dropping a block onto the floor), tell the subject to keep going. The experimenter will pick up the block and place it in its original position.



Purdue Pegboard Test (Modified)

Set-Up. Place board directly in front of subject, with row of cups at the far end of the board.
These cups should hold (from left to right): 25 pegs, washers, collars and 25 pegs.

ASSEMBLY TEST

1. **Instructions to Subject.** (Reverse for left-hand dominant subjects) "In this test you will pick up 1 pin from the right cup with your right hand, and while you are placing it in the top right-hand hole, pick up a washer with your left hand. As soon as the pin is placed, drop the washer over the pin. Meanwhile, pick up a collar with the right hand. Place it over the washer while picking up another washer with the left hand. Place the final washer over the pin and then start assembly of the next pin. Fill the pins into every other hole on the right side before starting on the left-hand holes.

PIN

WASHER

COLLAR

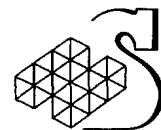
WASHER

2. **Practice.** Allow the subject to make 2 assemblies and watch them carefully to see that they are using the correct method. Return all parts.
3. **Timed Assembly Test.** Start timer on the command "GO". Tell subject to "STOP" at 120 seconds (2 min) elapsed time. Record number of parts correctly placed in 120 seconds. (Each completed assembly has 4 parts). Return parts to cups for next test.

Note. If the subject drops any component on the work surface or floor, immediately direct him to pick up a new part from the cups on the board. Keep timing the run. You might have to put parts back into the cups before they run out of parts.

Hand Grip Strength

1. **Set-up.** Set the adjustable handle to the desired spacing (see attached). Make sure that the handle clip is located at the lower/furthest post from the gauge (necessary for accurate readings). Rotate the red peak-hold needle counter-clockwise to 0.
2. **Subject Position.** Have subject stand comfortably with shoulder adducted and neutrally rotated. Elbow should be flexed to 90 degrees with the forearm and wrist in a neutral position.
3. **Test 1 (Dominant Hand).** Let subject hold instrument in his hand comfortably. Ask him to squeeze with his maximum strength. Record the highest force exerted (peak-hold needle) in kg. Re-set peak-hold needle to zero. Have subject switch instrument to non-dominant hand.
4. **Tests 2 to 4.** Repeat test with non-dominant hand, then dominant hand and repeat until 2 tests have been completed with each hand.
5. Calculate mean maximum force for each hand.



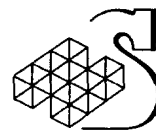
2-Point Discrimination Test

1. **Set-Up.** Subject will be seated, sideways to the table, with dominant hand outstretched onto the table and the subject's head turned in the opposite direction. Allow the subject's elbow to rest on the table palm side down. Hold the disk and prepare to direct the protruding pairs of prongs onto the subject's index finger (distal pad). The prongs should be held perpendicular to the long axis of the index finger.
2. **Instructions to Subject.** "I will be touching the tip of your index finger (of your dominant hand) with either single posts or pairs of small metal prongs/posts. I want you to tell me whether or not there is a single post or a pair of posts. Please feel free to press down harder or lighter in order to help you make your decision. You are not allowed to rock your finger back and forth in order to determine if there is 1 or 2 posts. We'll try a few tests until I can work out your threshold for detecting 2 separate posts. Please do not turn your head or eyes to see what I am doing."
3. **Procedure.** Randomly expose the subject and various pairs of posts. Continue until you can determine the smallest distance between posts at which the subject can just notice 2 posts instead of only 1. Expose the subject to the single post a few times during the test. Record the minimum distance at which 2 points are discriminated by the subject.
4. Record minimum distance (in mm) at which 2 points can be discriminated by the subject.
5. Repeat the test until you are confident in the threshold value.

C7 Magazine Loading Drill

1. **Set-up.** One empty magazine is positioned on the floor. 30 rounds of 5.56 ammunition are mixed up inside a combat cap. This is positioned beside the empty magazine. The subject stands, arms at his side, with the equipment positioned directly in front of him on the floor.
2. **Instructions to Subject.** "This is a speed test. On the command "GO", I want you to fill the empty magazine with all 30 rounds that are in the combat cap. You must do them individually, not using a magazine charger. As soon as the last round is seated, indicate that you are finished by yelling "Done". Empty the magazine on your own time and repeat."
3. **Practice Run.** Have the subject fill and remove 3 rounds. Go back to set-up condition.
4. **Timed Test 1.** Record the time required from the command "GO" until all 30 rounds are properly loaded into the magazine and the subject indicates "Done".
5. **Timed Test 2.** Record the time for the 2nd test.
6. Calculate the mean performance time.

Ask the subject for a rating and comments (i.e., explain any difficulties). Record any observations or comments.



Annex A
Test Procedures

C7 Rifle Handling Test

Note: Performance timings were not taken during the TCG evaluation.

1. Set-up. Subjects will be wearing webbing, with an empty magazine in his magazine pouch. Subjects will adopt the prone firing position, C7 rifle in hands, with weapon sight properly adjusted (by the subject wearing gloves on his own time).
2. Instructions to Subject. "You will be performing 3 basic weapon handling tasks, 2 of which will be timed: Load (timed), Aim/Fire (untimed), and Unload/Prepare for Inspection (timed)." Review drills and allow subject to practise drill if required.
3. 1st Timed Run.
4. Record time from the last syllable of the command "WITH A 30 ROUND MAGAZINE, LOAD", until the subject has closed the button on his pocket (time 1);
5. Allow the subject to "AIM/FIRE" on his own time; and
6. Record time from the last syllable of the command "UNLOAD, PREPARE FOR INSPECTION", until the subject has his weapon and mags ready for inspection (time 2).
7. 2nd Timed Run. Record times 1 and 2 for second run.
8. Sum times 1 and 2 for each timed run. Calculate mean overall C7 weapon task time.
9. Ask the subject for a rating and comments. Record these and any observations.

C6 MMG/ C9 LMG Handling Test

Note: Performance timings were not taken during the TCG evaluation.

1. Set-up. Subjects will be wearing webbing, with an empty ammo box in his C9 pouch (for C9 test only). Subjects will adopt the prone firing position, C9 or C6 in hands, with weapon sight properly adjusted (by the subject wearing gloves on his own time).
2. Instructions to Subject. "You will be performing 3 basic weapon handling tasks, 2 of which will be timed: Load (timed), Aim/Fire (untimed), and Unload/Prepare for Inspection (timed)." Review drills and allow subject to practise drill if required.
3. 1st Timed Run.
4. Record time from the last syllable of the command "LOAD", until the subject has closed the ammo pouch (if applicable), loaded the weapon and is ready to take a sight (time 1);
5. Allow the subject to "AIM/FIRE" on his own time; and
6. Record time from the last syllable of the command "UNLOAD, PREPARE FOR INSPECTION", until the subject has his weapon ready for inspection (time 2).
7. 2nd Timed Run. Record times 1 and 2 for second run.
8. Sum times 1 and 2 for each timed run. Calculate mean overall C9 weapon task time.
9. Ask the subject for a rating and comments. Record these and any observations.



Annex A
Test Procedures

Grenade Handling Test

Note: Performance timings were not taken during the TCG evaluation.

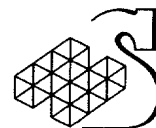
1. Set-up. 2-3 training/dummy grenades will be on a table.
2. Test. The subject is asked to try to perform grenade drills (less throwing) at least 2-3 times. No times will be recorded. The drills include:
 - a. Given the command, "PREPARE TO THROW", the grenade is held in the throwing hand in an overhand grip;
 - b. On the command, "READY", the subject prepares to arm the grenade (removes the safety clip, puts finger in pin);
 - c. On the command "THROW", the subject pulls the grenade away from the pin (and mimics throwing the grenade)
 - d. The subject will then put the grenade back together, while wearing the gloves.
3. The subject will be asked for ratings and comments. These and any observations will be recorded.

SRAAW / M72 Weapons Test

Note: Performance timings were not taken during the TCG evaluation.

1. Set-up. Subject will be standing, with SRAAW in left hand, right hand down at his side.
2. Instructions to Subject. "You will be performing 3 tasks, 2 of which will be timed: Prepare for Fire (timed), Fire (untimed), and Ceasefire/Make Safe (timed)." Review drills and allow subject to practise drill if required.
3. 1st Timed Run.
 - a. Record time from the first syllable of the "PREPARE FOR FIRE", until the trigger is in the armed position (time 1);
 - b. Allow the subject to "FIRE" on his own time; and
 - c. From the firing position, record time from first syllable of command "CEASEFIRE/MAKE SAFE" until the sling assembly has been replaced completely (subject should indicate "DONE") (time 2).
4. 2nd Timed Run. Record times 1 and 2 for second run.
5. Sum times 1 and 2 for each timed Run. Calculate mean overall SRAAW weapon task time.
6. Ask the subject for a rating and comments. Record these and any observations.

Note: If the subject drops any component of the M72, allow the subject to start over with the relevant portion that is being timed.



Annex A
Test Procedures

84 mm Handling Test

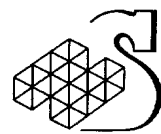
Note: Performance timings were not taken during the TCG evaluation.

1. Set-up. Subject will work in pairs. One subject will be standing, with SRAAW in left hand, right hand down at his side.
2. Instructions to Subjects. "You will be performing 4 tasks, 2 of which will be timed: Ready (timed), Load (timed), Fire (untimed), and Unload (untimed)." Review drills and allow subject to practise drills if required.
3. 1st Timed Run.
 - a. Record time from the first syllable of the "**READY**", until the subject is in the ready position (with sights adjusted) (time 1);
 - b. Record time from the first syllable of the "**LOAD**", until the trigger is in the armed position (time 2);
 - c. Allow the subject to "**FIRE**" on his own time; and
 - d. From the firing position, record time from first syllable of command "**UNLOAD/MAKE SAFE**" until the sling assembly has been replaced completely (subject should indicate "**DONE**") (time 2).
4. 2nd timed Run. Record times 1 and 2 for second run.
5. Have participants switch roles and repeat timed runs.
6. Sum times 1 and 2 for each timed run. Calculate mean overall 84 mm weapon task time.
7. Ask the subject for any comments. Record these and any observations.

Note: If the subject drops any component of the 84 mm, allow the subject to start over with the relevant portion that is being timed.

Jerry Can Carry

1. Set-up. Two jerry cans are positioned 10 meters apart (demarcated by chalk marks on the floor). Each can is filled with water to a weight of 30 pounds.
2. Subject Instructions. I would like you to pick up this jerry can with your dominant hand, carry it over to the other jerry can, set it down and bring the other jerry can back, again with your dominant hand. Do this task 2 times. This is not a timed task, but I would like you to pay attention to your ability to securely grip the can for carrying.
3. Once the subject has completed the task, ask him for a rating of the acceptability of the glove for the task of carrying loads in jerry cans.
4. Ask the subject for a rating and comments on their ability to do the task with the gloves. Record any observations or comments.



Annex A
Test Procedures

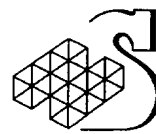
NBC Masking Drill

Note: Performance timings were not taken during the TCG evaluation.

1. Set-up. Subject stands in front of the table, with NBC mask and carrier slung, or attached to webbing. Review the NBC drill with the subject.
2. Instructions to Subjects. "I want you to perform a masking drill while wearing the cold/wet weather gloves. You will stand facing me with your arms hanging loosely at your sides. On the command "GAS, GAS, GAS", close your eyes/hold your breath, remove your mask from the carrier, don the mask, forcibly exhale, test the mask seal and shout "GAS, GAS, GAS" when you are finished. The task will be completed twice."
3. 1st Timed Test. Record the time from the command "GAS..." until the subject correctly completes his masking drill and calls "GAS...". Be sure that the subject followed all steps in the drill. If steps are missed, stop timing the subject and have him start over. Ask the subject to replace the mask in his carrier bag at his own time
4. 2nd Timed Test. Record the time taken.
5. Calculate mean mask donning time.
6. Ask subject for his comments. Record any observations/comments.

Sandbag Drill

1. Set-up. Sandbags will be emptied and located outside close to dirt and in a flat, grassy area.
2. Subject Instructions. "This is a compatibility test to determine the ease of filling sandbags with the gloves. This is not a timed test. You will work in pairs to hold and fill sandbags. Pay close attention to your ability to handle the sandbags, shovel and other items. Following the task, you will be asked to rate the ease of performing the sandbag drills, as well as provide comments."
3. Have the subjects each fill two sandbags.
4. Ask the subject for a rating and comments on their ability perform the sandbag drill. Record any observations or comments.

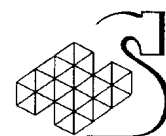


Annex A
Test Procedures

82 Pattern Webbing / Load Carriage Vest Compatibility

Note: Performance timings were not taken during the TCG evaluation.

1. Set-up. Place 1 empty magazine in the subjects ammo pouch of the webbing / LCV. Close the pouch. Ask the subject to adopt the prone position with the C7 Rifle.
2. Instructions to Subject. "This is another test of speed. When you hear me yell "GO" I want you to open the ammo pouch, remove the magazine, load the magazine into the weapon and take aim. I will stop timing as soon as you have taken a sight and you yell "DONE". When you hear me yell "GO" again, I want you to release the mag from the weapon, place the mag into your ammo pouch, and secure the closure (end of test).
3. 1st Timed Test. Record the time from the command "GO" until the subject has completed the drills.
4. 2nd Timed Test. Repeat above.
5. Calculate mean time to perform the drill.
6. Ask the subject for a rating and his comments. Record these and any observations.



ANNEX B:
Fit Questionnaire



Fit Questionnaire

PERSONAL DATA

Clearly indicate your Name and Glove Type in the boxes provided

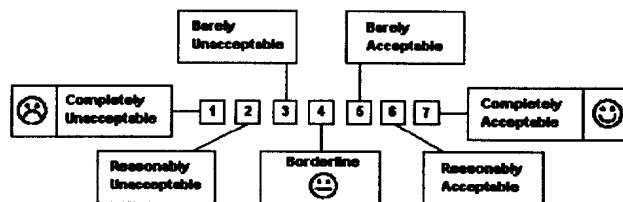
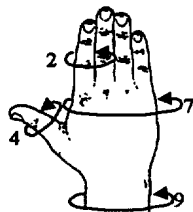
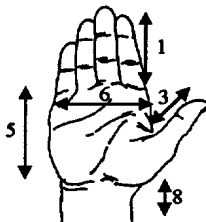
NAME

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

GLOVE TYPE

A ☐ B ☐

Don each glove size and perform manipulation tasks (i.e. mag load, touch fingers, make fist).

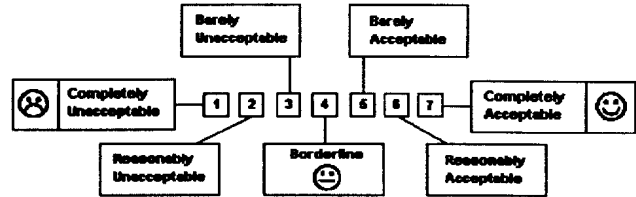
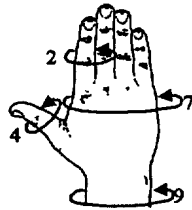
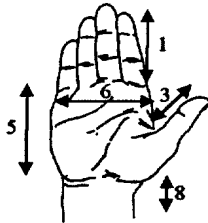


Rate the following features of the glove:	Size 1							Size 2							Size 3						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
1. Finger Length if rated 4 or less <	1	2	3	4				1	2	3	4				1	2	3	4			
	Too Short <input type="checkbox"/> Too Long <input type="checkbox"/>							Too Short <input type="checkbox"/> Too Long <input type="checkbox"/>							Too Short <input type="checkbox"/> Too Long <input type="checkbox"/>						
2. Finger Girth if rated 4 or less <	1	2	3	4				1	2	3	4				1	2	3	4			
	Too Small <input type="checkbox"/> Too Big <input type="checkbox"/>							Too Small <input type="checkbox"/> Too Big <input type="checkbox"/>							Too Small <input type="checkbox"/> Too Big <input type="checkbox"/>						
3. Thumb Length if rated 4 or less <	1	2	3	4				1	2	3	4				1	2	3	4			
	Too Short <input type="checkbox"/> Too Long <input type="checkbox"/>							Too Short <input type="checkbox"/> Too Long <input type="checkbox"/>							Too Short <input type="checkbox"/> Too Long <input type="checkbox"/>						
4. Thumb Girth if rated 4 or less <	1	2	3	4				1	2	3	4				1	2	3	4			
	Too Small <input type="checkbox"/> Too Big <input type="checkbox"/>							Too Small <input type="checkbox"/> Too Big <input type="checkbox"/>							Too Small <input type="checkbox"/> Too Big <input type="checkbox"/>						
5. Palm Length if rated 4 or less <	1	2	3	4				1	2	3	4				1	2	3	4			
	Too Short <input type="checkbox"/> Too Long <input type="checkbox"/>							Too Short <input type="checkbox"/> Too Long <input type="checkbox"/>							Too Short <input type="checkbox"/> Too Long <input type="checkbox"/>						
6. Palm Breadth if rated 4 or less <	1	2	3	4				1	2	3	4				1	2	3	4			
	Too Narrow <input type="checkbox"/> Too Wide <input type="checkbox"/>							Too Narrow <input type="checkbox"/> Too Wide <input type="checkbox"/>							Too Narrow <input type="checkbox"/> Too Wide <input type="checkbox"/>						
7. Palm Girth if rated 4 or less <	1	2	3	4				1	2	3	4				1	2	3	4			
	Too Small <input type="checkbox"/> Too Big <input type="checkbox"/>							Too Small <input type="checkbox"/> Too Big <input type="checkbox"/>							Too Small <input type="checkbox"/> Too Big <input type="checkbox"/>						
8. Wrist Length if rated 4 or less <	1	2	3	4				1	2	3	4				1	2	3	4			
	Too Short <input type="checkbox"/> Too Long <input type="checkbox"/>							Too Short <input type="checkbox"/> Too Long <input type="checkbox"/>							Too Short <input type="checkbox"/> Too Long <input type="checkbox"/>						
9. Wrist Girth if rated 4 or less <	1	2	3	4				1	2	3	4				1	2	3	4			
	Too Small <input type="checkbox"/> Too Big <input type="checkbox"/>							Too Small <input type="checkbox"/> Too Big <input type="checkbox"/>							Too Small <input type="checkbox"/> Too Big <input type="checkbox"/>						
10. Overall Fit																					



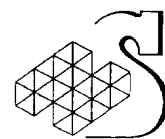
Fit Questionnaire

Don each glove size and perform manipulation tasks (i.e. mag load, touch fingers, make fist).



Rate the following features of this glove:	Size 4	Size 5	Size 6
1. Finger Length if rated 4 or less <	1 2 3 4 5 6 7 Too Short <input type="checkbox"/> Too Long <input type="checkbox"/>	1 2 3 4 5 6 7 Too Short <input type="checkbox"/> Too Long <input type="checkbox"/>	1 2 3 4 5 6 7 Too Short <input type="checkbox"/> Too Long <input type="checkbox"/>
2. Finger Girth if rated 4 or less <	1 2 3 4 5 6 7 Too Small <input type="checkbox"/> Too Big <input type="checkbox"/>	1 2 3 4 5 6 7 Too Small <input type="checkbox"/> Too Big <input type="checkbox"/>	1 2 3 4 5 6 7 Too Small <input type="checkbox"/> Too Big <input type="checkbox"/>
3. Thumb Length if rated 4 or less <	1 2 3 4 5 6 7 Too Short <input type="checkbox"/> Too Long <input type="checkbox"/>	1 2 3 4 5 6 7 Too Short <input type="checkbox"/> Too Long <input type="checkbox"/>	1 2 3 4 5 6 7 Too Short <input type="checkbox"/> Too Long <input type="checkbox"/>
4. Thumb Girth if rated 4 or less <	1 2 3 4 5 6 7 Too Small <input type="checkbox"/> Too Big <input type="checkbox"/>	1 2 3 4 5 6 7 Too Small <input type="checkbox"/> Too Big <input type="checkbox"/>	1 2 3 4 5 6 7 Too Small <input type="checkbox"/> Too Big <input type="checkbox"/>
5. Palm Length if rated 4 or less <	1 2 3 4 5 6 7 Too Short <input type="checkbox"/> Too Long <input type="checkbox"/>	1 2 3 4 5 6 7 Too Short <input type="checkbox"/> Too Long <input type="checkbox"/>	1 2 3 4 5 6 7 Too Short <input type="checkbox"/> Too Long <input type="checkbox"/>
6. Palm Breadth if rated 4 or less <	1 2 3 4 5 6 7 Too Narrow <input type="checkbox"/> Too Wide <input type="checkbox"/>	1 2 3 4 5 6 7 Too Narrow <input type="checkbox"/> Too Wide <input type="checkbox"/>	1 2 3 4 5 6 7 Too Narrow <input type="checkbox"/> Too Wide <input type="checkbox"/>
7. Palm Girth if rated 4 or less <	1 2 3 4 5 6 7 Too Small <input type="checkbox"/> Too Big <input type="checkbox"/>	1 2 3 4 5 6 7 Too Small <input type="checkbox"/> Too Big <input type="checkbox"/>	1 2 3 4 5 6 7 Too Small <input type="checkbox"/> Too Big <input type="checkbox"/>
8. Wrist Length if rated 4 or less <	1 2 3 4 5 6 7 Too Short <input type="checkbox"/> Too Long <input type="checkbox"/>	1 2 3 4 5 6 7 Too Short <input type="checkbox"/> Too Long <input type="checkbox"/>	1 2 3 4 5 6 7 Too Short <input type="checkbox"/> Too Long <input type="checkbox"/>
9. Wrist Girth if rated 4 or less <	1 2 3 4 5 6 7 Too Small <input type="checkbox"/> Too Big <input type="checkbox"/>	1 2 3 4 5 6 7 Too Small <input type="checkbox"/> Too Big <input type="checkbox"/>	1 2 3 4 5 6 7 Too Small <input type="checkbox"/> Too Big <input type="checkbox"/>
10. Overall Fit	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>

Please use the back of this sheet to provide comments.



ANNEX C:
Accessibility / Adjustability
Questionnaire



Accessibility/Adjustability

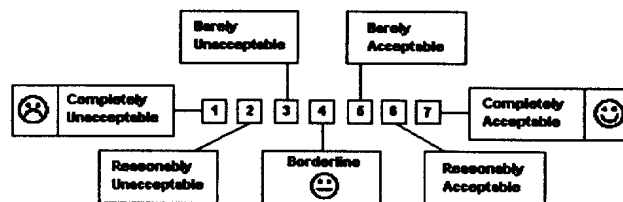
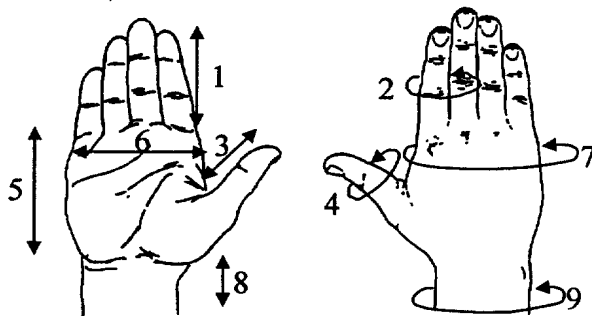
PERSONAL DATA Clearly indicate your Name, Glove Type, and Glove Size in the boxes provided.

NAME:

GLOVE TYPE: A ☐ B ☐

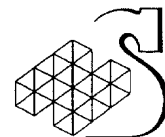
Determine which size provides the best fit and complete the following questions.

SIZE OF BEST FIT: 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐



Rate the following	Acceptance Rating	Comments
	<div> </div> <div> 1 2 3 4 5 6 </div>	
1. Donning Glove	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
2. Adjusting Wrist	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
3. Cuff Closure Protection	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
4. Doffing Gloves	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
5. Overall Accessibility	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
6. Overall Adjustability	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	

Please use the space below to provide comments.



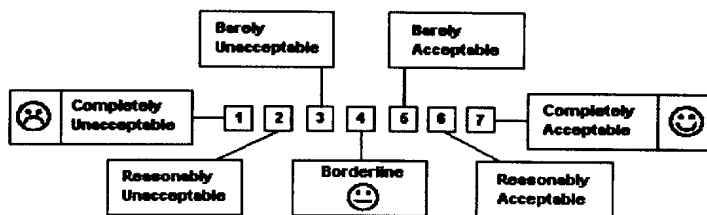
ANNEX D:
Obstacles and Tasks
Questionnaire



Obstacles and Tasks

NAME: _____

GLOVE TYPE: A ☐ B ☐

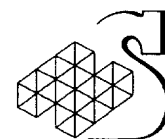


Section A: Performance

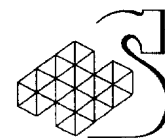
	1 2 3 4 5 6 7	Comments
Rope Climb Obstacle	○ ○ ○ ○ ○ ○ ○	
Ladder Obstacle	○ ○ ○ ○ ○ ○ ○	
Crawl (Low Wire Obstacle)	○ ○ ○ ○ ○ ○ ○	
Wall Obstacle	○ ○ ○ ○ ○ ○ ○	
Over and Under Obstacle	○ ○ ○ ○ ○ ○ ○	
Mouse Hole Obstacle	○ ○ ○ ○ ○ ○ ○	
Digging	○ ○ ○ ○ ○ ○ ○	
Handling Sandbags	○ ○ ○ ○ ○ ○ ○	
Grenade Handling/Throw	○ ○ ○ ○ ○ ○ ○	

Section B: Overall Ratings

	1 2 3 4 5 6 7	Comments
Grip	○ ○ ○ ○ ○ ○ ○	
Tactility (sense of touch)	○ ○ ○ ○ ○ ○ ○	
Dexterity (manipulation)	○ ○ ○ ○ ○ ○ ○	
Physical Comfort	○ ○ ○ ○ ○ ○ ○	
Thermal Comfort	○ ○ ○ ○ ○ ○ ○	
Protection	○ ○ ○ ○ ○ ○ ○	
Overall Performance on Obstacles	○ ○ ○ ○ ○ ○ ○	
Overall Performance on Defensive Position Tasks	○ ○ ○ ○ ○ ○ ○	



ANNEX E:
Task Questionnaire - Range



ANNEX F:
Comfort Questionnaire



Comfort Questionnaire

PERSONAL DATA

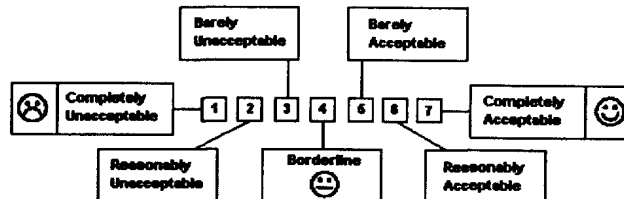
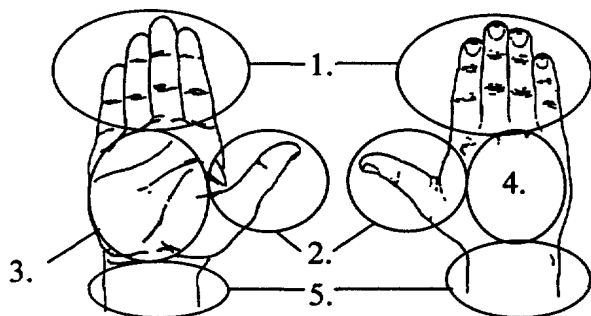
Clearly Indicate your Name and Glove Type in the boxes provided

NAME:

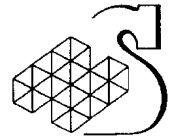
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GLOVE TYPE:

A ☐ B ☐



Physical Comfort	1 2 3 4 5 6 7	Comments
1. Fingers Physical Comfort	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
2. Thumb Physical Comfort	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
3. Palm Physical Comfort	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
4. Wrist Physical Comfort	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
5. Backside of Hand Physical Comfort	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
6. Overall Physical Comfort	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
Thermal Comfort	⊕ 1 2 3 4 5 6 7 ⊖	Comments
1. Finger Thermal Comfort	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
2. Thumb Thermal Comfort	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
3. Palm Thermal Comfort	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
4. Wrist Thermal Comfort	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
5. Backside of Hand Thermal Comfort	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
6. Overall Thermal Comfort	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	



ANNEX G:
Exit Questionnaire



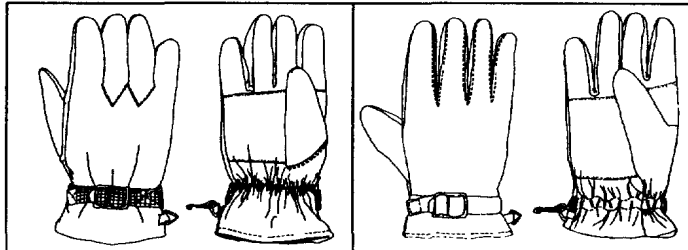
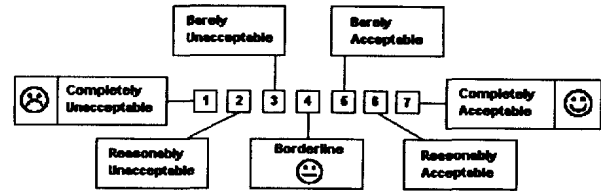
Exit Questionnaire

PERSONAL DATA

Clearly indicate your Name in the boxes provided.

NAME

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--



Glove A

Glove B

Comments

Rate the following Performance Criteria

Accessibility

1	2	3	4	5	6	7
---	---	---	---	---	---	---

1	2	3	4	5	6	7
---	---	---	---	---	---	---

Adjustability

1	2	3	4	5	6	7
---	---	---	---	---	---	---

1	2	3	4	5	6	7
---	---	---	---	---	---	---

Appearance

1	2	3	4	5	6	7
---	---	---	---	---	---	---

1	2	3	4	5	6	7
---	---	---	---	---	---	---

Clothing Compat.

1	2	3	4	5	6	7
---	---	---	---	---	---	---

1	2	3	4	5	6	7
---	---	---	---	---	---	---

Cuff Closure Prot.

1	2	3	4	5	6	7
---	---	---	---	---	---	---

1	2	3	4	5	6	7
---	---	---	---	---	---	---

Dexterity

1	2	3	4	5	6	7
---	---	---	---	---	---	---

1	2	3	4	5	6	7
---	---	---	---	---	---	---

Durability

1	2	3	4	5	6	7
---	---	---	---	---	---	---

1	2	3	4	5	6	7
---	---	---	---	---	---	---

Dryability

1	2	3	4	5	6	7
---	---	---	---	---	---	---

1	2	3	4	5	6	7
---	---	---	---	---	---	---

Equipment Compat.

1	2	3	4	5	6	7
---	---	---	---	---	---	---

1	2	3	4	5	6	7
---	---	---	---	---	---	---

Fit

1	2	3	4	5	6	7
---	---	---	---	---	---	---

1	2	3	4	5	6	7
---	---	---	---	---	---	---

Grip

1	2	3	4	5	6	7
---	---	---	---	---	---	---

1	2	3	4	5	6	7
---	---	---	---	---	---	---

Maintainability

1	2	3	4	5	6	7
---	---	---	---	---	---	---

1	2	3	4	5	6	7
---	---	---	---	---	---	---

Obstacle Course Perf.

1	2	3	4	5	6	7
---	---	---	---	---	---	---

1	2	3	4	5	6	7
---	---	---	---	---	---	---

Physical Comfort

1	2	3	4	5	6	7
---	---	---	---	---	---	---

1	2	3	4	5	6	7
---	---	---	---	---	---	---

Prep. of Def. Posn.

1	2	3	4	5	6	7
---	---	---	---	---	---	---

1	2	3	4	5	6	7
---	---	---	---	---	---	---

Protection

1	2	3	4	5	6	7
---	---	---	---	---	---	---

1	2	3	4	5	6	7
---	---	---	---	---	---	---

Tactility

1	2	3	4	5	6	7
---	---	---	---	---	---	---

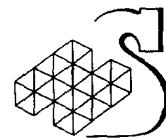
1	2	3	4	5	6	7
---	---	---	---	---	---	---



Exit Questionnaire

Rate the following Performance Criteria	Glove A							Glove B							Comments
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	
Thermal Comfort	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Vehicle Compat.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Water Resistance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Weapon Compat.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
OVERALL ACCEPTANCE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Please use the space below to provide additional comments.



ANNEX H:
Criteria Importance
Questionnaire



Criteria Importance Questionnaire

PERSONAL DATA

Clearly indicate your Name in the boxes provided.

NAME

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

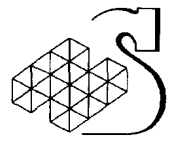
Criteria Importance:

	Of No Importance	Of Minor Importance	Of Little Importance	Of Some Importance	Moderately Important	Very Important
Accessibility (don/doff)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Adjustability	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Appearance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Clothing Compatibility	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cuff Closure Environ. Protection	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Dexterity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Dryability	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Durability	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Equip. Compatibility	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
FIBUA Performance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fire & Movement Perform.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fit	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Grenade Throwing Perf.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Grip	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Maintainability	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Obstacle Course Perform.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Physical Comfort	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Preparation of Defensive Position Performance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Protection	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tactility	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Thermal Comfort	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Vehicle Compatibility	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Water Resistance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Weapon Compatibility	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please use the space below to provide comments.



Humansystems Incorporated



ANNEX I:
Features Questionnaire



Features Questionnaire

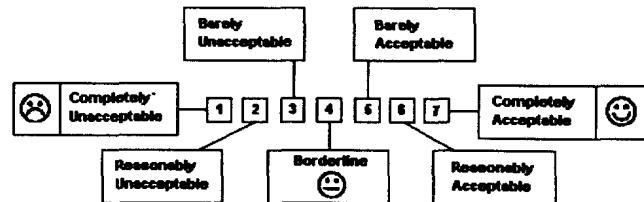
PERSONAL DATA

Clearly indicate your Name in the boxes provided.

NAME

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Provide an acceptance rating for each feature listed below.

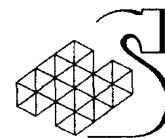


Categories	Features	Acceptance Rating						
		1	2	3	4	5	6	7
Material	Goatskin Leather	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Type of Cut	Reverse Gunn Cut (Glove A)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Inseam Sewn Cut (Glove B)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cuff	Cuff Length	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Wrist Strap	Wrist Strap Material	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Wrist Strap Position	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Buckle Glove A	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Buckle Glove B	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Elastic Wrist Strap	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other Features	Reinforced Palm	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Water Resistant Finish	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Coupling Device	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please use the space below to provide comments.



Humansystems Incorporated



ANNEX J:
Session Questionnaire

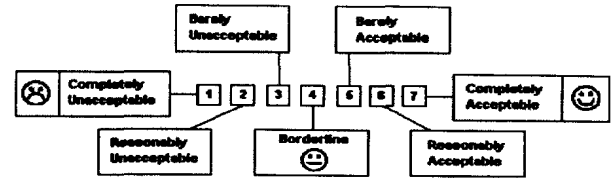


TCG Session Questionnaire

NAME: _____

GLOVE TYPE: A ☐ B ☐

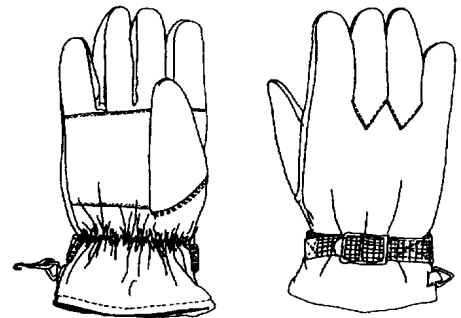
ESTIMATED DAYS OF USE: _____



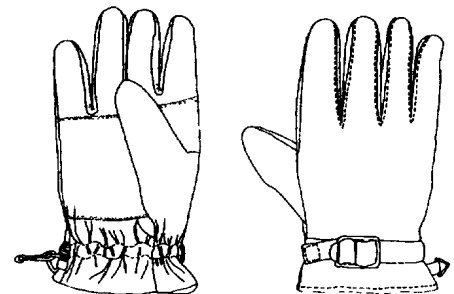
Section A: Specific Features

	Function (works well)	Durability (wears well)
1. Glove Design/Cut	○○○○○○○○	○○○○○○○○
2. Cuff	○○○○○○○○	○○○○○○○○
3. Wrist Strap Material	○○○○○○○○	○○○○○○○○
4. Wrist Strap Buckle	○○○○○○○○	○○○○○○○○
5. Wrist Strap Elastic	○○○○○○○○	○○○○○○○○
6. Reinforced Palm	○○○○○○○○	○○○○○○○○
7. Type of Leather	○○○○○○○○	○○○○○○○○
8. Leather Finish	○○○○○○○○	○○○○○○○○
9. Coupling Device	○○○○○○○○	○○○○○○○○

GLOVE A

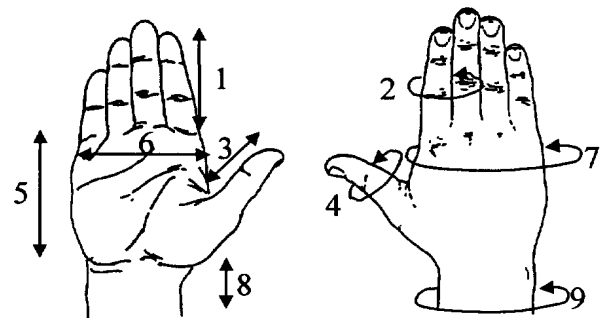


GLOVE B



Section B: Comfort and Fit

	Acceptability (○ = good, ○ = fair, ○ = poor)	Fit (○ = small, ○ = OK, ○ = big)		
1. Finger Length	○○○○○○○○	○	○	○
2. Finger Girth	○○○○○○○○	○	○	○
3. Thumb Length	○○○○○○○○	○	○	○
4. Thumb Girth	○○○○○○○○	○	○	○
5. Palm Length	○○○○○○○○	○	○	○
6. Palm Breadth	○○○○○○○○	○	○	○
7. Palm Girth	○○○○○○○○	○	○	○
8. Wrist Length	○○○○○○○○	○	○	○
9. Wrist Girth	○○○○○○○○	○	○	○
Change in Fit	○○○○○○○○	○	○	○
Overall Fit	○○○○○○○○	○	○	○





TCG Session Questionnaire

Section C: Whole Item

Activities	Experience			Acceptability	Compatibility	Adjustment			Acceptability
	None	Some	Good			None	Some	Good	
Weapon Handling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	C7 Mag. Load	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Weapon Firing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	C7 Rifle	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Weapon Sighting	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	C9 LMG	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Handling Mags.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	9mm Pistol	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Load/Unload Wpn.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	M72	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Accessing Pockets	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	84 mm	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Climbing Ladders	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	C6 MMG	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Prep. Def. Posn.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Grenade Handling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Digging / Trenches	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Grenade Throwing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Material Handling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Mortars	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Handling Sandbags	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Jerry Can Carry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using the Machete	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Coleman Stove	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using the Pick	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Radio Comms.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Obstacles	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Multi-Tool	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fire and Movement	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Binoculars	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Parachuting	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	NODLR	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Rappelling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Helmet	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
FIBUA	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	NBC C4 Mask	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Garrison Activities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	IECS Jacket	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Vehicle Exit / Entry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Rain Jacket	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Vehicle Operation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	82 Pattern Webbing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Suitability for:					Load Carriage Vest	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Extreme Cold -10°C or colder	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fragmentation Vest	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cold -10°C to 0°C	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Adjustment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cool 0°C to 10°C	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Putting on	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Warm 10°C to 20°C	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Adjusting cuff	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hot 20°C or above	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Taking off	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Maintenance:						<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cleaning	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Time to Dry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Repairs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



Section D: Overall Ratings

	Acceptability
	☹️ 😐 😊
Fit : Rate the extent to which you can achieve a suitable fit with the gloves.	○ ○ ○ ○ ○ ○ ○ ○
Weapons Compatibility : Rate the overall compatibility with weapons.	○ ○ ○ ○ ○ ○ ○ ○
Equipment Compatibility : Rate the overall compatibility with equipment.	○ ○ ○ ○ ○ ○ ○ ○
Tactility : Rate the degree to which the gloves affect the sense of touch.	○ ○ ○ ○ ○ ○ ○ ○
Dexterity : Rate the performance of hand tasks involving fine finger manipulation.	○ ○ ○ ○ ○ ○ ○ ○
Protection : Rate the degree to which the gloves prevent cuts, puncture and scrapes.	○ ○ ○ ○ ○ ○ ○ ○
Grip : Rate the degree to which the gloves affect tasks involving grip strength.	○ ○ ○ ○ ○ ○ ○ ○
Physical Comfort : Rate the degree to which the gloves contribute to comfort.	○ ○ ○ ○ ○ ○ ○ ○
Durability : Rate the degree to which the gloves resist wear and tear.	○ ○ ○ ○ ○ ○ ○ ○
Accessibility : Rate the relative ease with which the gloves can be donned or doffed.	○ ○ ○ ○ ○ ○ ○ ○
Adjustability : Rate the adjustments of the gloves to achieve an acceptable fit.	○ ○ ○ ○ ○ ○ ○ ○
Clothing Compatibility : Rate the overall compatibility with clothing.	○ ○ ○ ○ ○ ○ ○ ○
Vehicle Compatibility : Rate the overall compatibility with vehicles.	○ ○ ○ ○ ○ ○ ○ ○
Functionality : Rate the degree to which the gloves affect your performance of tasks.	○ ○ ○ ○ ○ ○ ○ ○
Thermal Comfort : Rate the degree to which the gloves contribute to heat gain or cooling for its intended climatic category (10°C to 35°C, dry or wet).	○ ○ ○ ○ ○ ○ ○ ○
Physical Comfort : Rate the degree to which the gloves contribute to comfort.	○ ○ ○ ○ ○ ○ ○ ○
Maintainability : Rate the ease and effectiveness of minor glove cleaning and repair.	○ ○ ○ ○ ○ ○ ○ ○
Water Resistance : Rate the degree to which the glove repels water.	○ ○ ○ ○ ○ ○ ○ ○
Appearance : Rate the degree to which the gloves present a professional military image.	○ ○ ○ ○ ○ ○ ○ ○
User Acceptance : Rate the degree to which the glove is acceptable for service.	○ ○ ○ ○ ○ ○ ○ ○

Section E: Comments

[illegible]

SECURITY CLASSIFICATION OF FORM
(highest classification of Title, Abstract, Keywords)

DOCUMENT CONTROL DATA

(Security classification of title, body of abstract and indexing annotation must be entered when the overall document is classified)

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As part of the Clothe the Soldier project, the Defence and Civil Institute of Environmental Medicine (DCIEM) was tasked to support the acquisition of temperate combat gloves (TCG). The TCG is a one-piece glove (i.e. no insert) intended to provide the essential dexterity and abrasion protection in temperatures of 10°C to 35°C. This report describes the results of a Human Factors evaluation trial conducted to resolve differences in fit and design (i.e. cut) and determine if two new prototype glove designs were compliant with Human Factors performance specifications. Thirty-six regular force soldiers were selected for specific hand sizes from Whiskey Battery at CFB Gagetown and were given temperate combat gloves. All participants took part in an uncontrolled portion of the trial. Participants issued only one pair of gloves had an opportunity to expose one glove to 95 days of operational use, and half that time for those issued two pair. Data was collected primarily to assess performance criteria requiring extended operational use (fit (change in fit), protection, durability, and maintainability). Twenty-one participants took part in the controlled portion of the trial. A two-day field trial was undertaken at CFB Gagetown over the period of November 4-5, 1999. Participants issued two pairs of gloves were required to undertake a battery of Human Factors tests while wearing the different temperate glove conditions in a repeated measures design. Human Factors tests included assessments of fit, accessibility, adjustability, compatibility, performance of clinical, military and battle tasks, thermal and physical comfort, durability, and user acceptance. Data collection included questionnaires, focus groups, performance measures and HF observer assessments. The results indicated that both gloves were compliant with most of the HF performance requirements tested in this trial with the exception of Fit Acceptance, Gross Motor Dexterity Performance and Grip Strength Performance. Rewording of the Gross Motor Dexterity and Grip Strength Performance requirements are suggested. In terms of Fit, more than 80% of the participants included in this trial were able to achieve an acceptable overall fit. However, many individual components of the glove were rated as "too big" or "too small". In addition, the sample population used in the trial lacked representation of large hands, small hands, and hands with long fingers. In terms of design only, participants preferred the Inseam Sewn Cut to the Reverse Gunn Cut. All participants indicated that the ideal glove would be Inseam Sewn Cut and retain the benefits of glove A. Results indicated that following 90 days of operational use, most soldiers (80% or greater) rated the durability, protection, and maintainability of the temperate combat gloves as acceptable. The next phase of the Temperate Combat Glove project should produce and evaluate new TCG prototypes in a User Acceptability Trial. Issues related to developing a working sizing system for a more representative sample of the CF Land Force population also require further research. The Human Factors performance criteria and test methods, as validated (and modified) in the current study, should be used to support future acquisition decisions in the effort to select the best possible glove for the Canadian Land Forces.

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